

ABC'S OF RELOADING

(3rd Edition)

**By
Dean A. Grennell**

DBI BOOKS, INC., NORTHFIELD, ILLINOIS

About Our Cover

We are proud to have RCBS products represented on the covers of this, the 3rd Edition of *The ABC's OF RELOADING*. From their humble beginning at the close of WWII, the Good Old Boys at RCBS have consistently met the needs of reloaders both here in the U.S. and around the world.

Seen on our cover is a selection of current RCBS handloading gear. In the center of the cover you'll see the RCBS RS2 press. While the RS2 is light in weight, it will handle any popular metallic cartridge. (Note the offset O-frame design.) In the background you'll also see the new Sidewinder™ case tumbler. The Sidewinder is unique in design and will handle any case-polishing chore with ease. Also seen is an RCBS rotary case trimmer loading tray, case lube, pad and brush, a powder scale, dies and more. That's the way it is at RCBS—they've got it all. Photo by John Hanusin.



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Betty Burris
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As always, a book such as this is the end-result of efforts, help and contributive input from a great many people; a number so large that any attempt to list them all is certain to see some left out and the omitted names always turn out to have been among the most deserving. With that stipulation, I'll give it my best shot. Be it firmly noted, there is no significance at all in the order of listing!

At DBI Books, we have Sheldon Factor, Robert S. L. Anderson, Harold Murtz and Chuck Hartigan.

In the home office of Gallant/Charger Publications, where all this was put together, the list grows larger and includes Sonya Kaiser, Jack Lewis, June Carlier, Janet Sperber, Connie Royce, Dorine Imbach, Kerri Burris, Tracy Jackson, Rueselle Gilbert, Kristin Bunn, Betty Burris, Cynthia Forrest and Dana Silzle.

A special 21-shot "salud!" to Bill Mauldin for his masterful portrayal of the alleged author, due to appear within the next few pages.

Many friends and well-wishers in the shooting/reloading industry have made contributions to the book at hand, a lot of them quite invaluable. Those include, but are by no means limited to: Dave Corbin, Dave Andrews, Paul Beck, Mike Wright, Steve Hornady, Jim Hull, John Adams, James Gibbs, Wayne Gibbs, Bill Ruger and his sons, Walt and Anne Stephenson, Warren Center, Wayne Baker, Dick Casull, Elgin Gates, Richard Beebe, Marty Liggins, the Hodgdon Clan — as headed by Uncle Bruce — Bill Dillon, Dick Dietz, Fred Huntington, Kevin Parsons, Bill Siems, Hugh Reed, Johnny Falk, Richard Steele, Tony Sailer, Joe St. Denis, Harband Singh, Dan Bechtel, Sid Bell, Ray Katt, Bob Loveless, Herman Schneider, John Bianchi, Dean Purdie, Bob Ray, Barbara Mellman, Dave Ecker, George and Esther Miller, Turner Kirkland, Reinhart Fajen, Lee Jurras, Earle Harrington, Don Burton, Steve Herrett, Bob Magee, Kris Colongeli, Rudy Herman, Dick Lee, Ken Ramage, Jim Hurlbert, Al Mar, Wayne Wixom, Frank Pachmayr, Gene Peterson, Jim and Clara Normington, Jim Rock, Neale Perkins, Bill Bach, Mike Bussard, Bob and Barbara Hayden, Bob Hass, Bill Clede, Jon Sundra, Tim Pancurak, Bob Gustafson, Albert Thumler, Ralph Walker, Roy Weatherby, Duane Small, Bob and Frank Brownell, Buzz and Bonnie Huntington, Rich Brokken, Bruce Cavey, Harry Sanford, Goeff Barclay, Jim Bell, Steve Vogel, Chip Hewlett, Skip Gordon, Ted Curtis, Richard Nichols, J.D. Jones, Danny Bork, John and Barbara Hansen, Stan Newman, Diane McCarthy, George Engledow, Sharon Cunningham, Becky Bowen, Mike Dixon, Bob Ruch, Brad Woodbury, John Bressemer, John Delaney, Arlen Chaney, Clem Confessore, Ed Bousquet, Elden Robison, Chub Eastman, Mace Thompson, Phil Chase, Larry and Barb Kelly, Bill Minneman, Bob Clausen, Tony Aeschliman, Ted Bachhuber, Bill Chevalier, Robbin Riley, Johnathon Phillips, Cliff Ashbrook, Peter Kirker and Garth Choate.

If you feel your name belongs there, and it isn't, you're indubitably right. Letter it into the margin and I'll validate it. And please accept my apologies!

There are still others, beyond those and I refer to my fellow Fellows of the American College of Experimental Ballisticians, not all of whom are fellows in the common context, but we tend to get a bit anti-semantic about that. Their names include: John Ellison, Ernest Marrs, Ralph Grennell, Gerry Kincannon, Bill Rotsler, Bill Mauldin, Gib Berndt, Bill and Lucy Corson, Dick Morgan, Magali Akle, Carl Wood, Jim Horton, Claud Hamilton, Tom and Tina Ferguson, Kent and Becky Cartwright, Sherry Weening, and Midge Dandridge.

The book, however, is dedicated to Larry T. Shaw, much over-belatedly, but with sincere gratitude, for all that. The name may ring no bell with most, but his contribution was as vital as anything hardly ever gets. In the early Fifties, I was straining to launch my literary career by writing science-fiction. Shaw was editing an s-f magazine called *Infinity* in those days. I met him at a gathering of s-f people at Indian Lake, Ohio, early in 1953 and, in the course of conversation, must have mentioned my interest in guns and, more specifically, in reloading. For the record, I got two s-f stories published and, three years later, managed to collect a penny a word for them. In the meantime, the publisher of *Infinity* had added a gunzine to the offering, staffed primarily with people from around the New York area. After the second issue, the chap they'd signed on to write about reloading — they called it handloading — created a vacancy on the masthead, quite abruptly.

That must have triggered an emergency staff meeting, with the deadline for the third issue coming up and Shaw, bless his heart and nearby giblets, must have recalled the guy he met at Indian Lake who reloaded. At any rate, I got an urgent note from Shaw, asking if I could/would step into the breach. I gave it a go. They ran it and paid for it in less than a year. I suspect some may have speculated as to how I became a gunwriter. It is an example of the way seemingly small events can divert a person's lifestream. Had it not been for Shaw's benevolent intervention, this book and a lot of other published copy might have carried other bylines. So it goes. Thanks, Larry!

A short time ago, I got back to Wisconsin on a business trip, stopped to visit brother Ralph and his family and, in the course of our fraternal dialogue, Ralph advised me that he was really the one who'd put me onto the concept of the K-Spinner, as discussed later in the present book. He showed me some examples of his early prototypes and it came to me that his claim was quite correct. To paraphrase Twain, I can forget anything, whether it happened or not. Ralph's samples carried a pin on down to emerge through the flash hole. All I did was to establish that that wasn't essential. As you encounter discussion of the K-Spinner in the pages ahead, please keep all this in mind. And remind me if I forget it again, please?

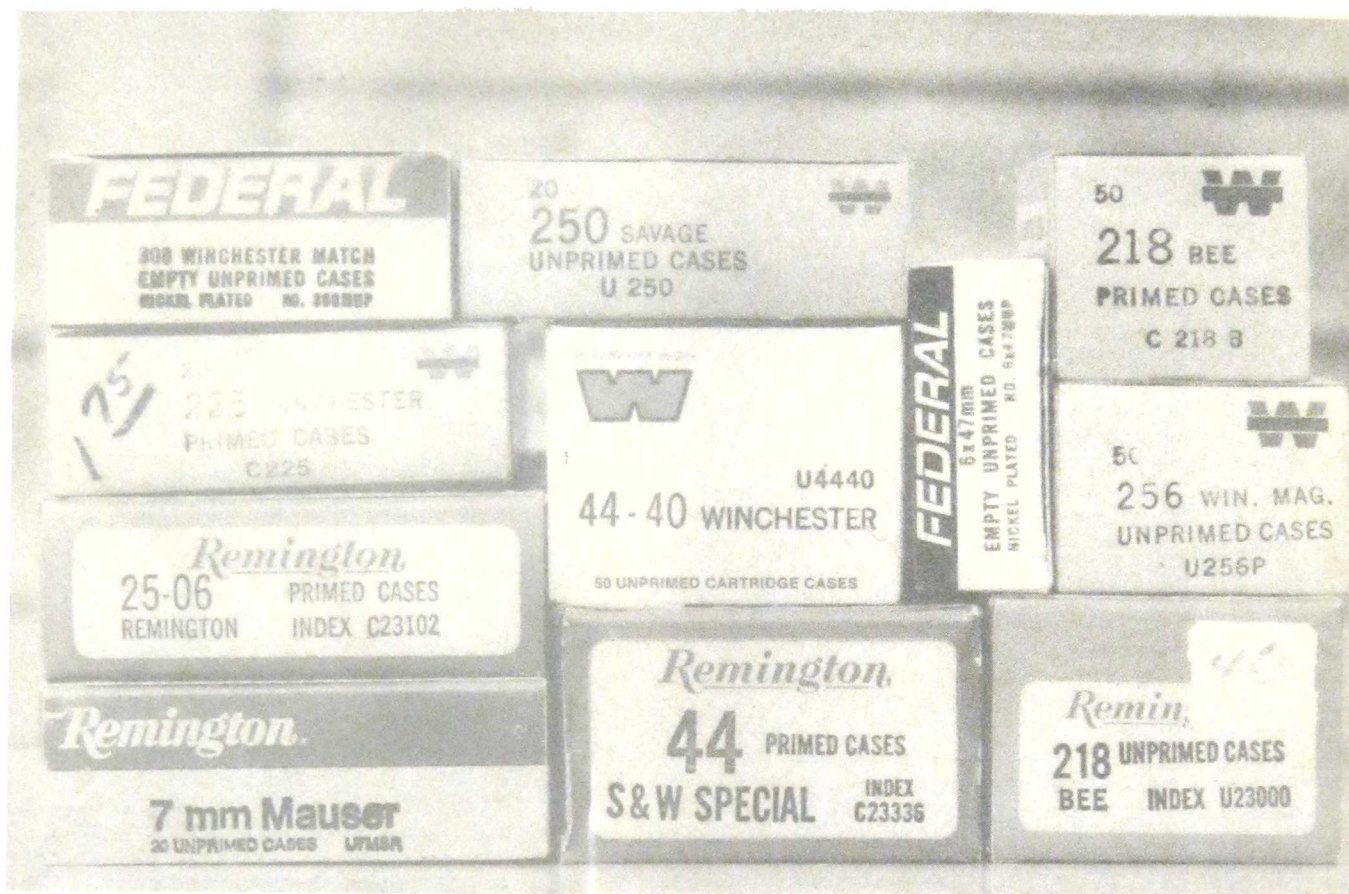
As in earlier books, the final but most grateful acknowledgment goes to my wife, Jean, for her patience in putting up with me through the birth-pangs of yet another manuscript, to say nothing of its accompanying artwork. "C'est-DAGuerre Labs" is the home darkroom: all fourteen square feet of it. That doesn't count the kitchen sink, the chemical stains left around it and the use of Jean's cherished microwave oven to time the steps of film processing. This is Jean's book, too, even if her name doesn't appear on the cover.

Which brings us to you, gentle reader: a member of the gun-loving, book-buying reloading public, without whose encouragement and support, none of this would be possible. As always, may your tribe increase!

With cordial best regards,



Dean A. Grennell



Above: Empty cases can be had in most center-fire calibers, primed or unprimed. Prices here suggest that some of the boxes were purchased long ago. This is a good way to augment your brass supply, costing less than factory loads. (Opposite) Bill Mauldin, two-time Pulitzer prize-winning cartoonist, dreamed up this illustration showing how one can charm exceptional performance out of nearly any gun by means of resourceful reloading.

THE BASIC BASICS

Covering The Why And The How Of Reloading,
As Well As Other Somewhat Related Matters

HUMOR ME to enter a bit of background data, please? When the first of these books was going onto paper, some while back, its tentative working title was *Reloaders Reference Digest* and it was completed to fit that title. At some point between the typewriter and the roaring presses, the title underwent a sea-change to the one it wears through the present. By no means do I deplore the title, nor do I wish to seem to. I think it's a great title. I wish I'd thought of it, myself. It has helped to sell several copies.

When the second edition came under the gun, the title was firmly fixed and I made every effort to punch it out so that the veriest neophyte would not be confused on any point. It no longer seems illogical, but I got quite a bit of

feedback from people who'd bought both editions and the solid consensus was that it didn't come off as well as the first edition.

Gentle readers, I hear you loud and clear, I hope. Yes, mindful of the condition of my ears, that's remarkable. Thus, be duly advised that, here in the third go-round, an effort will be made to honor the nominal title but, now and again, we may inlay a bit of DEFs, some PQRs and perhaps a fast flash of UVWs. In all honest candor, I'm not certain I know any of the XYZs, myself.

One thing we will not be doing, consistent with past track record, is to fill page after page with listings of load data. There are a goodly number of manuals and handbooks readily available to today's reloader and we will be review-





ing some of those later on here. I sincerely believe any reloader should have at least one of those for consultation; several if possible. All such works carry some amount of auxiliary information, some quite a good bit of it. Nonetheless, it's my conviction the reloader needs a helpful guiding-hand book to enable him or her to get the most out of the manuals and handbooks. I regard the space available here as barely enough for the stated purpose. Let us now get on to the topic immediately at hand and thank you for letting me get that off my chest.

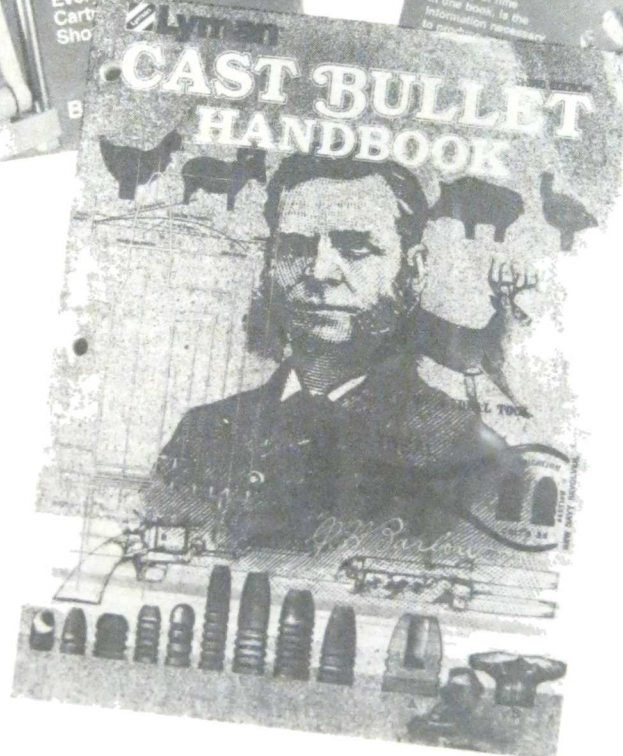
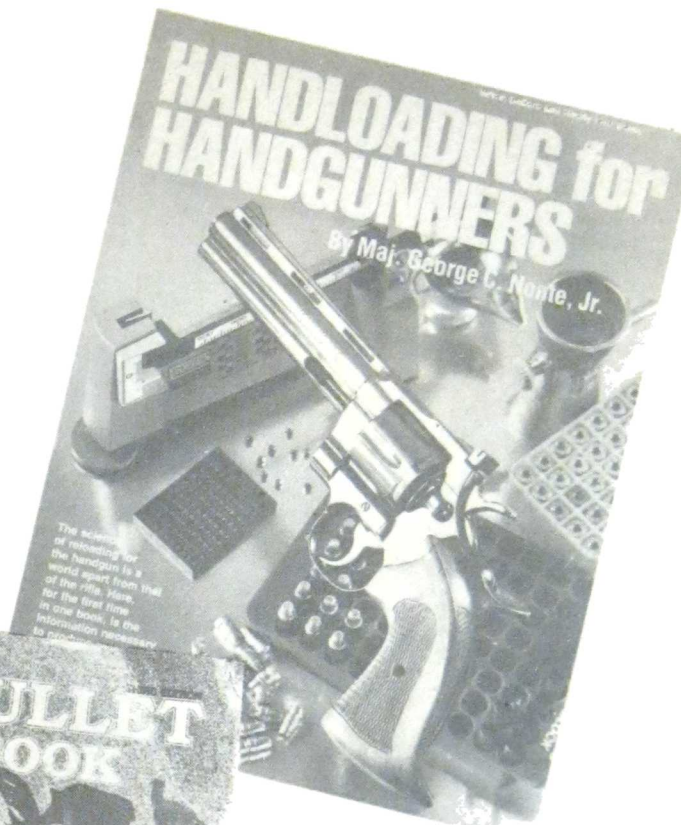
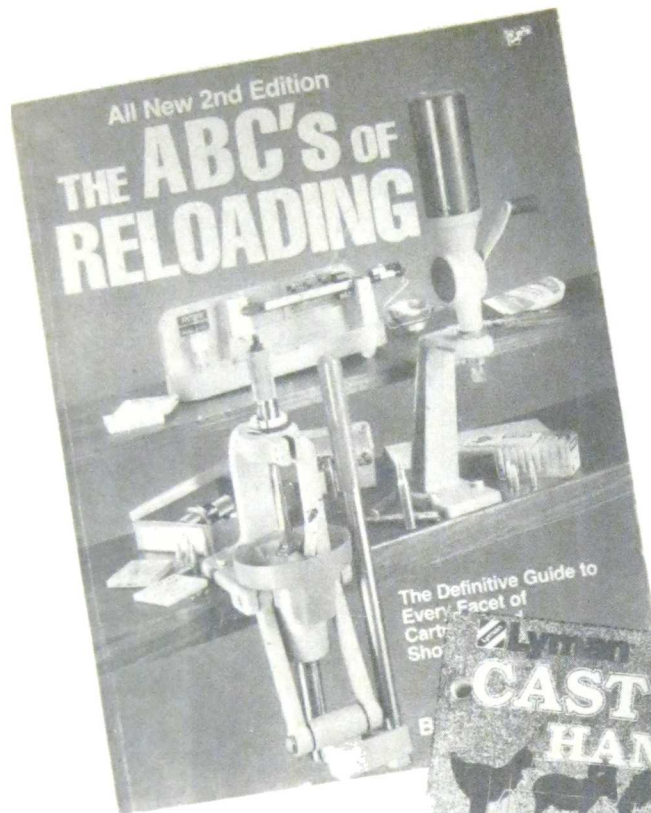
RELOADING/HANDLOADING —?

The two terms are nearly synonymous. If you buy virgin brass cases, prime them, add charges of powder, going on

to seat bullets in them, that's handloading. If they had been fired at least once before and you proceed to resurrect them, that's reloading and, at the same time, handloading, as well. The vast bulk of all handloading is also reloading. The books that offer the nitty-gritty details are known as reloading/handloading manuals/handbooks, in about equal measure. If there is any distinction between a manual and a handbook, I've never heard the details on it.

WHY RELOAD?

One of the most expensive components of the center-fire cartridges is the brass case that puts it all together. Some of the cases cost forty cents, eighty cents, up to a couple bucks a whack, perhaps even more. If you fire and go off



Lyman Cast Bullet Handbook is available from Lyman or their dealers. Other titles shown are from DBI Books, available from them or from Sportsman's Bookshop, Box HH, Capistrano Beach, CA 92624. Latter may be the only source for ABC/R1, appearing at upper left, opposite.

leaving such a costly artifact on the ground, you're not only a litterbug, you're a spendthrift litterbug. As we shall see, it lies within your *easy* ability to make that spent case back into a live round, as good as when freshly purchased, perhaps even a good deal better. In nearly all instances, the cost of reloading is less than the value of the case itself.

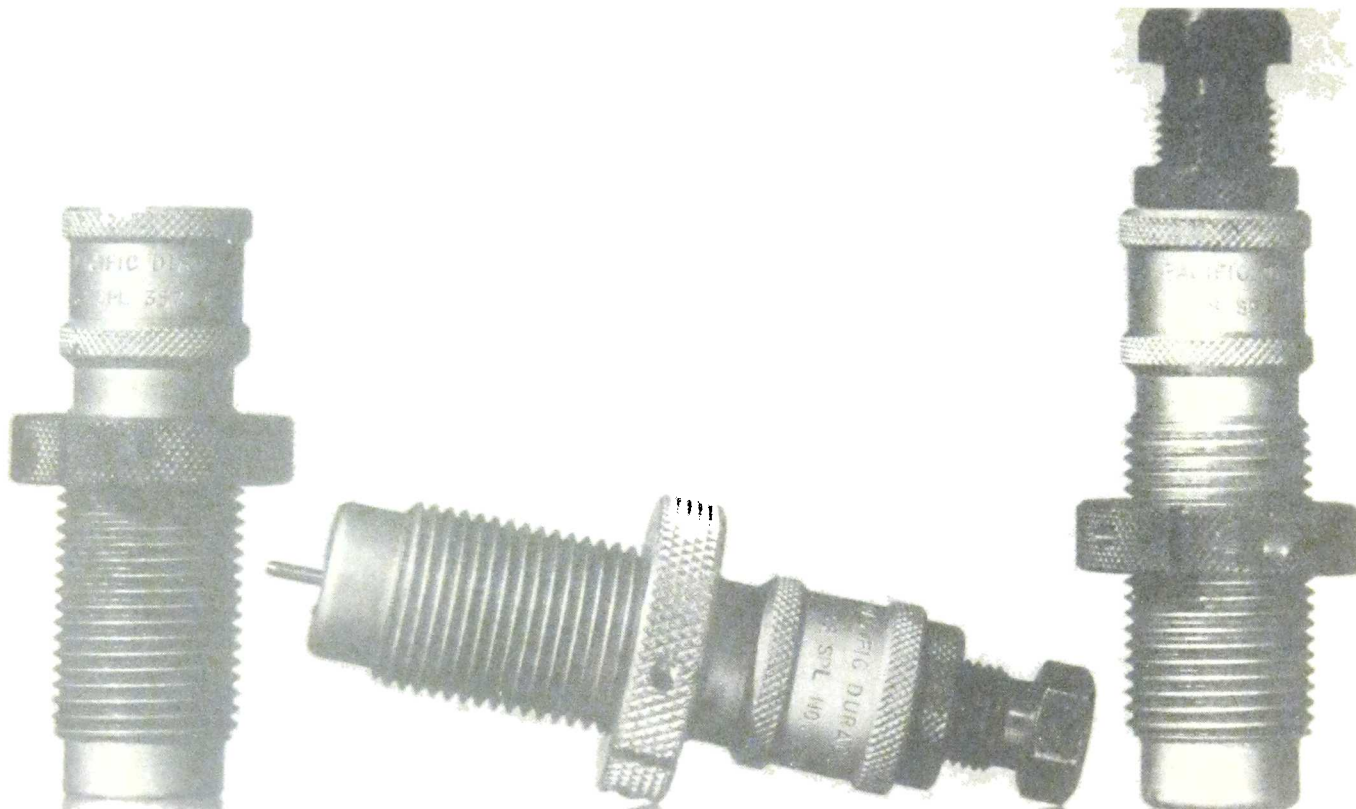
Does that mean that, by reloading, you'll be able to save so much money you can look forward to early retirement? Probably not. If you enjoy shooting and like to do a lot of it, reloading can and will stretch your ammo outlay in a manner most useful and gratifying. It makes your shooting dollar go a lot farther.

If you hunt once a year and a twenty-round box of factory ammo lasts you for the better part of a decade, put the

book back on the rack and walk away. Reloading is not for you. No hard feelings, okay?

If you enjoy pulling the trigger and hearing it go bang, and feel that some amount of practice will make you a better shot — you're probably right — reloading can put a generous quantity of practice ammo at your disposal for a moderate outlay in cash and person-hours.

Reloading takes many forms and it should be noted, to avoid misunderstanding, that it is not practical to reload rimfire ammunition such as the familiar .22 long rifle cartridge. It can be done. Some have done so for the sake of proving a point. Some people, presumably, get their jollies by working crossword puzzles in obscure dialects of Sanskrit. Other folks, other strokes. Reloading, as discussed



Above: A three-die set in .38 Special by Hornady/Pacific, with a tungsten carbide full-length resizing die (left) which lets you resize without need to lubricate the cases. These dies can be used to reload the .357 magnum, also. Center die is the combination decapper/neck-expander and die at right is the bullet seater.

.41 REMINGTON MAGNUM

REM. N.F. CASE; REM. 2½ P.
SIERRA 170 GR. JHC; .410" DIA.;
10" PISTOL BBL.; 1.575" C.O.L.

"Hi Skor"

700-X	8.4	1375	39800
PB	11.3	1460	40000
SR 7625	10.8	1485	39400
SR 4756	14.6	1650	39600
IMR 4227	23.00	1605	32900

"Hi-Skor"

800-X	14.6	1760	39200
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Here's a reproduction of Du Pont's data for the .41 magnum. Note how the 800-X load turns out 110 fps of additional velocity over SR 4756, but with less peak pressure. This out-performs factory loads.

here, is confined to the revivification of spent cases and hulls of center-fire persuasion, whether for handgun, rifle or shotgun. In the first two, the further presumption is that the cases were Boxer-primed. The fine distinction between Boxer priming and Berdan priming will be covered in a later chapter.

We will devote some discussion to shotshell reloading, although the bulk of the book will concern the metallics; a term covering ammo for handguns and rifles. The publishers of the book at hand have produced a title — *Reloading For Shotgunners* — that covers the topic in more than adequate depth, as well as another, *Metallic Cartridge Reloading*.

In an earlier era, the late Phil Sharpe put forth a monumental work under the title, *Complete Guide To Handloading*. Its later editions covered about 680 large pages with small type and, y'know? — it never said word doodley-zilch about reloading shotshells. So much for truth-intitling.

No slightestmost slur is intended to the shade of the good Sharpe. Quite the contrary, I owe the gent a debt of gratitude I can never hope to repay. He got me hooked and wired into all this absorbing business and all I've been doing, down the years, is trying to get down on paper the stuff I wish I'd had at my fingertips when I was the rankest beginner ever to shamle down the pike.



Here's the custom Smith & Wesson .41 magnum mentioned on page 13. It was created by Leon Smith (Box 773, Redding, CA 96001) from a Model 28 S&W originally chambered for .357 magnum. Smith used Dan Wesson Arms barrels and barrel shrouds to provide interchangeable barrels such as the 2 $\frac{3}{4}$ -inch one shown, also a 4- and 16-inch. As noted, the "Smith-Smith & Wesson-Wesson," as I call it, went 1465 fps/810 fpe with 800-X load.

COMMON FALLACIES & MYTHS

Reloading is dreadfully complex and complicated.

Reloading is inherently dangerous.

Reloading is a rich person's game.

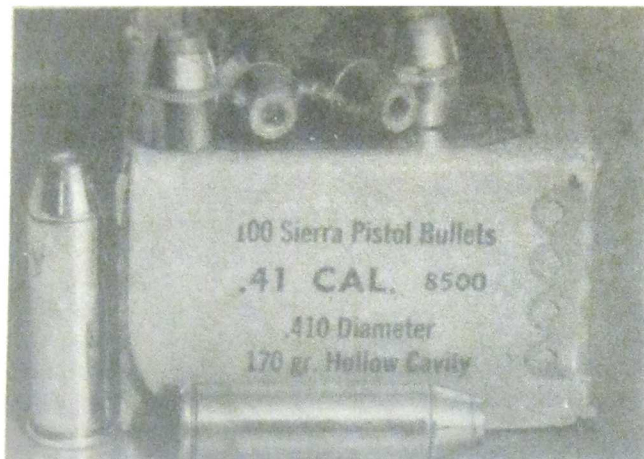
As with most if not all fallacies, none of those can be substantiated, let alone justified. Given the rudimentary basic equipment, reloading is almost ludicrously simple. Just about any untalented ding-a-ling that comes along can master it. I mastered it fairly well. Need you any proof beyond that?

Dangerous? Yes, you can get hurt doing it, as you can manage at an incredible number of other activities and pursuits. A friend of mine slipped and killed himself while taking a shower. Nearly any morning, I steel my courage up and take a shower, no matter what. I only avoid the hazard when I sense a need for apartness that day. In the next chapter, we'll be discussing ways to minimize the hazards,

so's to put it down among the actuarially attractive activities, about on a par with blindfold horseshoes, if not even better than that.

Reloading expensive? Were that true, it wouldn't be this popular. Time was, not too long back, you could get a Lee Loader kit for about ten bucks, a deck of primers for another dollar, a can of powder for a five-spot, if not less, and a hundred bullets for about the same outlay. Something like one steel-engraving of Andy Jackson could make you a potential competitor to Alfie Krupp himself. That assumed you had a mallet in hand, already; mallets aforethought, as it could be termed.

Just about everything costs more today and probably [sigh!] will cost more a bit later. When could you buy a ten-buck Lee Loader kit, you could get pretty decent ground beef for thirty-nine cents a pound and mail a letter for eight or ten. Today, postage is twice that and fairly unfatty hamburger costs five-fold. Getting into reloading today, on a slim



Here's the Sierra 170-grain jacketed hollow cavity (JHC) bullet that turns the .41 magnum into a formidable affair with the load using Du Pont 800-X as the propellant.

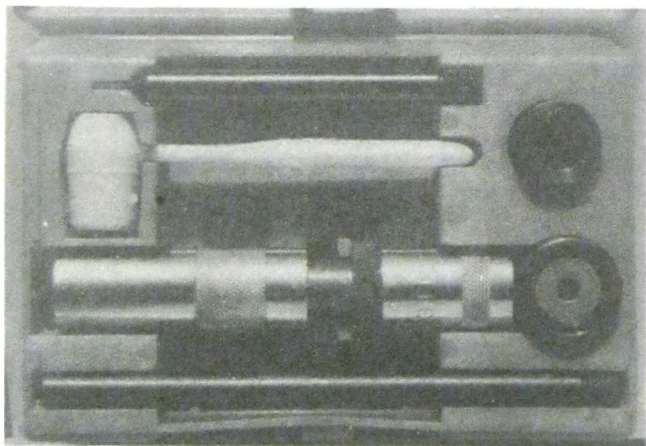
budget, remains bring-outable on these terms for change back from a fifty, probably. Double the ante and you — like the chap who erected a six-story condominium on the back of his Harley-Davidson — can live fairly high on the hog. Further details are scheduled to appear in Chapter 3.

Reloading, *mes enfants*, remains one of the great, attractive bargains still waiting to be snapped at, in my humble opinion (imho). Given proper tutelage, it is reasonably simple, rewarding, safe and inexpensive.

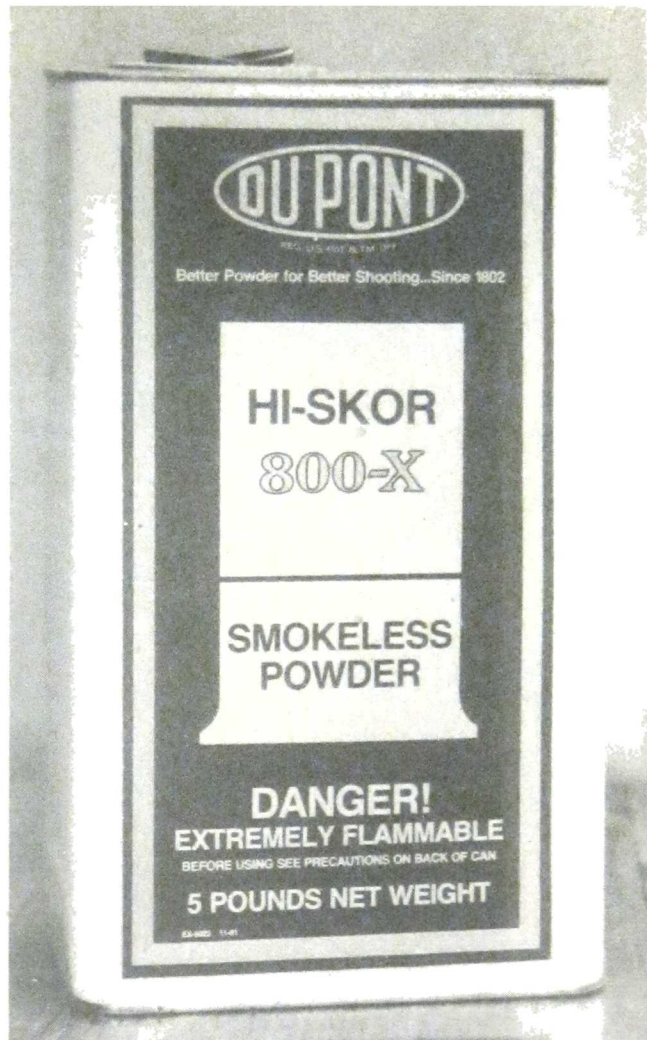
WHAT'S MORE...

The capabilities for reloading enable you to conjure up cartridges that cannot be bought in the marketplace. Commercial ammomakers fairly well have to restrict their offerings to those combinations apt to sell briskly. Not so, the reloader can load just about any weight or type of bullet into any case, provided it's the proper diameter.

Thus, if you fancy some .350 Remington magnum cartridges loaded with Speer's 140-grain jacketed hollow point (JHP) handgun bullet, it's an easy and simple project to make up a batch of them. Load data for that unusual combo appears on page 288 of the #10 Speer Manual. My



Here's the Lee Precision loading kit in .30/06, with powder measuring dipper and everything you need to reload the cartridge for further firing out of the same gun.



Du Pont's Hi-Skor 800-X is still so new on the scene that only Du Pont's tables carry data for it. Primarily a shotshell powder, it shows promise for handgun use.

old Model 600 Remington likes 58.0 grains of Hercules Reloder 7 behind that bullet — the middle load on Speer's list — and groups about two inches at one hundred yards on it. Recoil is moderate and impact performance is slightly incredible.

Not only can you tap a much greater variety of bullets for any given cartridge, but you can also modify the velocity downward from the usual factory specs; only rarely can you modify it upward and then only if a recognized data source sanctions the charge.

If you have a pretty clear idea of what you're about — a keenly pertinent qualification! — you can load down to reduce velocities, recoil, penetration and report level, often retaining highly gratifying accuracy. The Thompson/Center Contender single-shot pistol with the .22 Hornet barrel is a versatile performer with such loads, as but one example.

I'll give one more example of a sanctioned recipe available by reloading that exceeds the usual factory load performance by a substantial margin. When Du Pont introduced their 800-X powder in 1982, they listed a load in their *Handloader's Guide* for the .41 magnum with the



The .350 Remington magnum was another of those ill-fated cartridges that never won even a small percentage of the popularity it richly deserved. In the factory loading, with the 250-grain bullet, its kick is downright murderous. The 140-grain JHP was pioneered by Speer and performs with good accuracy and moderate recoil in the rifle cartridge. Hornady and Sierra have added 140-grain IHPs to their respective lines.

Sierra 170-grain jacketed hollow cavity (JHC) bullet and 14.6 grains of 800-X. Tested in a ten-inch Contender barrel, the quoted velocity was 1760 feet per second (fps) at 39,200 copper units of pressure (c.u.p.). That was 110 fps faster than the loads listed for any of the other Du Pont powders, at a bit less pressure than most of them.

Testing that load, I held the charge to an average of 14.5 grains and my ten-inch Contender averaged 1898 fps; average velocity from a fourteen-inch Contender barrel was 2001 fps. Wondering how it would perform in a shorter barrel, I tried the load in a custom Smith & Wesson revolver having a 2¼-inch barrel and, even in that, velocities ran as high as 1465 fps. The muzzle blast from the snub-nose, I should note, was truly awesome.

I have at least three guns for the old .45 Auto Rim (AR) cartridge and have always been fond of that round. Remington offers the .45 AR as a factory load, but only with a 230-grain round nose (RN) lead bullet. The #10 Speer Manual lists loads with four different powders that take their excellent 200-grain JHP bullet to velocities above 900 fps, thereby turning the stubby little cartridge into a fully certificated Mean Mullah.

But, as was noted, you can't expect to find boxes of that load awaiting your purchase at the friendly neighborhood emporium of shooting supplies. You have to either construct them yourself or — one other possible alternative —

locate a custom reloader whose skills you trust, and hire it done.

Perhaps you fancy some mid-range target wadcutter loads for your .357, .41 or .44 magnums, or for a pet .44 Special. Again, the do-it-yourself approach is strongly indicated, economical and, after you learn the ropes, a lot of good, clean fun.

A FAIRLY BOTTOMLESS PITCHER

Fashions come and go in cartridge calibers, just as they do in clothing and many other things. There are a lot of nice old cameras for which film is no longer to be had, automobiles for which parts are extremely scarce if obtainable at all, and so on. If you depend upon factory ammo, quite a number of useful firearms are already faced with a pinched-off supply. If you reload, you can keep those booming lustily for many a decade yet unborn.

If you've a good supply of empty cases, a set of loading dies, a mould for casting the bullets and a set of lube/sizing dies for processing the cast bullets, you can load and shoot until the cases wear out. With judicious care, that involves a great many loadings per individual case. Often it is possible to modify or convert a still-available case into the format of an obsolete one. The late Maj. George C. Nonte, Jr., authored two excellent books on that aspect of reloading. The title was *The Home Guide To Cartridge Conver-*



The 45 Auto Rim is factory-loaded only by Remington, using a 250-grain round nose bullet. Reloaded with Speer's 200-grain JHP, the round takes on new life.

sions, first and second editions. The second edition is the one to get, as it contains all the material in the first edition plus a generous amount of additional data. The second edition was copyrighted in 1967 and the publisher is Stackpole Company, Cameron & Kelker Streets, Harrisburg, PA 17105. I'm not sure if this one remains in print, but, if not, you can keep an eye peeled for a copy at gun shows and the like.

Another situation in which the reloader is apt to feel much gratitude is if the supply of factory ammunition undergoes severe attrition. That can happen and it has happened. One hopes it never happens again, but there's no way to make sure of that.

The salient example is the interlude from late 1941 until well after late 1945. Guns, ammunition, equipment and components for reloading were simply not to be had. In fact, it was rather a long time after WWII before such consumer goods began straggling back into a hungry market.

Today's reloader can take some fairly positive steps to make sure guns on hand do not run dry for a long time to come; with self-imposed rationing, should the situation ever deteriorate to such levels again. Primers are neither overly expensive nor bulky and the prudent soul keeps a number of cartons of one thousand apiece on the back shelves, buying to replace expended stock and rotating so as to use up the oldest ones next in line. Sensibly stored, primers are next door to immortal. I've some on hand that were bought thirty years ago and they still work just fine. Most smokeless powders keep at least as well. I've a few cans that are crowding fifty years out of the plant and performance remains unimpaired. In that light, study the comments on powder storage in Chapter 2 thoughtfully.

The big Cuban Missile Scare of the early Sixties triggered a vast wave of panic buying among reloaders who still retained a clear recollection of how tough things were in WWII days. They came in convoys: pickup trucks, stations wagons and family sedans pulling trailers. Dealers in reloading supplies found their shelves scoured clean, as if by a plague of locusts. That all blew over, thankfully enough, and the dealers restocked with no problems.

No comparable panic has occurred within recent times, but that's not to say it couldn't happen. Mindful of that, the

prudent reloader takes some pains to maintain stockpiles at a basic level of adequacy for any reasonably possible emergency situation. If my own sources were wiped out tomorrow morning — provided stocks on hand were not confiscated — I could maintain a sparse but telling *snap-crackle-pop* until well into the Twenty-First Century. Many other shooter/reloaders keep themselves in a similar state of readiness and I commend such approaches to your consideration.

To stockpile a comparable armory entirely of factory loads would require much larger expenditures in cash laid out and storage space. The secret lies in the valuable metallic cartridge case and, to a somewhat lesser extent, in the refillable shotshell hull. Think about it, hmm?

ACCURACY IN RELOADS

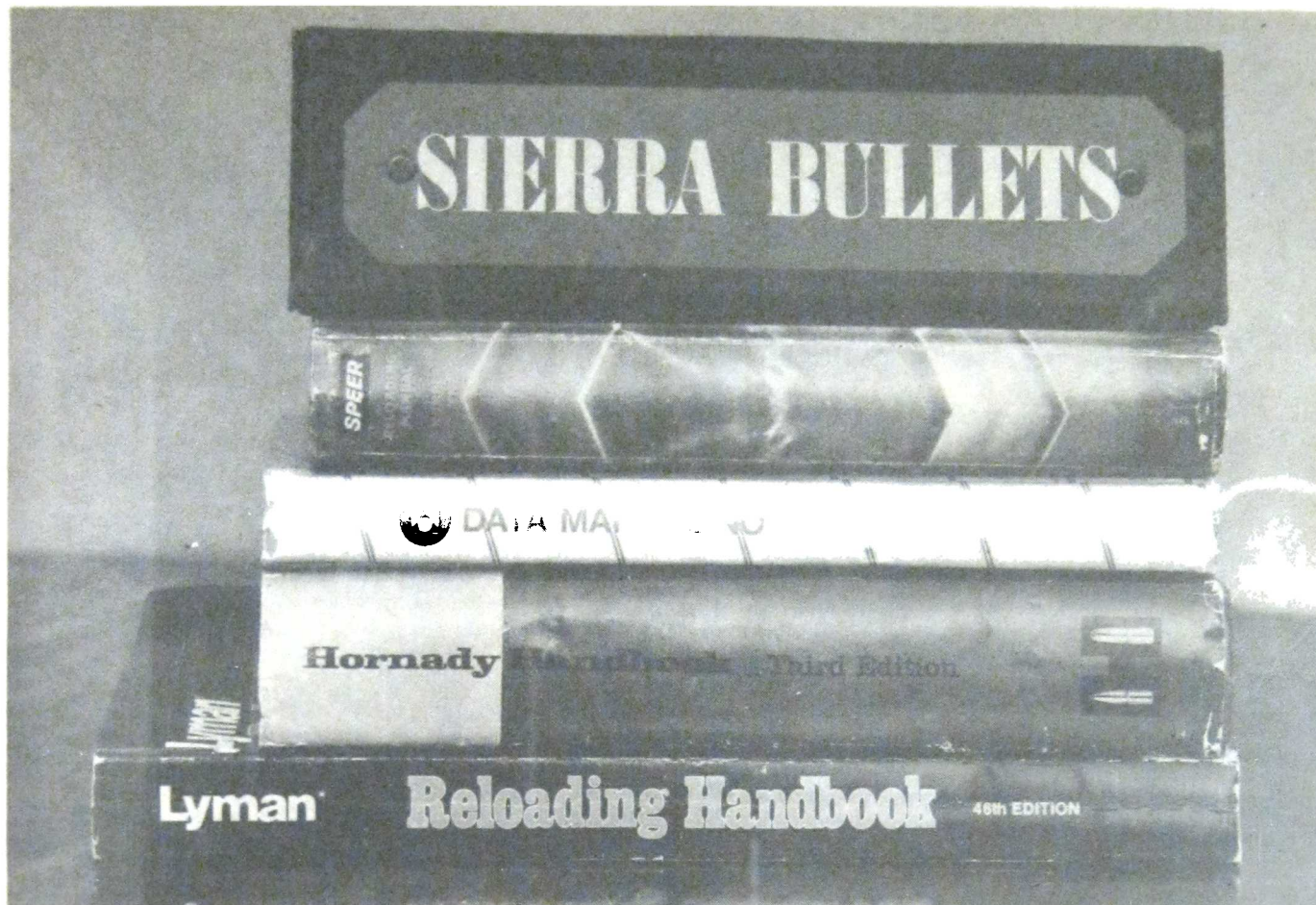
I have an old book in which the author flatly states the best accuracy is obtainable only with high-quality factory loads and reloads are a poor also-ran. At the time he wrote that, it's conceivable that he was correct. That was back in the Twenties or perhaps the Thirties, when reloading was far from as intensively explored as in these more recent times.

The key point is that no cartridge — factory-fresh or reloaded — performs exactly the same out of each and every gun chambered for it. I have no justified reason for bad-mouthing factory ammo. Once, a few years ago, I set forth to run a test on a Remington Model 700 Classic rifle in .243 Winchester and started out with some Frontier Cartridge ammo carrying the 75-grain Hornady JHP bullet. The first five shots out of that brand-new rifle went into a group that had a maximum spread of .585-inch between centers at one hundred yards! I was gratified, but ruefully had to admit it didn't leave much room for improvement.

More recently, I was doing another field test, this time with the Thompson/Center TCR 83 single-shot rifle which, like their Contender pistol, features barrels that can be interchanged to handle different cartridges. I was using a barrel for the .223 Remington cartridge and it performed quite well with an assortment of factory loads. Due to climatic considerations, it'd been necessary to set up the target 115 yards from the shooting bench. Moving on to some reloads I'd made up to try, I fired five rounds that put the Sierra #1400 bullet — their .224-inch, 53-grain, Bench Rest Hollow Point — into a maximum center spread of just .457-inch.

Even as you, I found that hard to believe. That's less than one-half minute of angle (MOA). One MOA at one hundred yards is about 1.05 inches. By rule-of-thumb standards, it takes a pretty decent bolt-action rifle to crack the MOA barrier and you hardly expect a break-action single-shot to do twice as well. Heck, the TCR 83 doesn't even have a bull barrel!

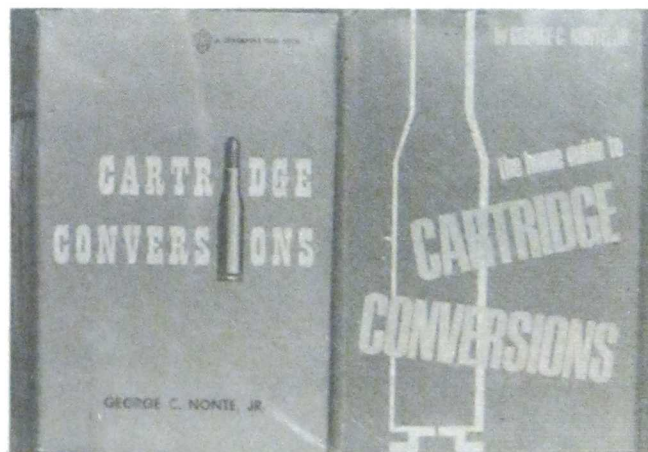
As rifle cartridges go, I'm extremely fond of the .22-250 Remington and have more rifles for that cartridge than for any other. Down the years, I've become partial to a starting load of 33.3 grains of Du Pont IMR-4064 powder behind the 52-grain Speer JHP bullet for the .22-250 Remington. I've never found a rifle that shot really badly with that load and most of them handle it quite well. It's between the bottom and middle load in the Speer Manual, starting out at around 3400 fps.



A reloader's best friend is a collection of handbooks and manuals giving the suitable weights of the different powders for use in various cartridges with bullets of a given weight. New editions appear rather infrequently and are eagerly awaited. One should follow their recommendations scrupulously.

Nonetheless, it's possible to track down a specific load that will do just a little bit better in any given .22-250 rifle if you settle down to try several different charges of all the suitable powders behind the vast variety of available bullets. Even pegged to minimum and maximum limits, the number of possible reloads for any cartridge tends to approach infinity. Given sufficient patience, dogged determination and time to pursue the matter, it is possible to isolate some remarkably capable reloads for any reasonably decent rifle before its bore becomes hopelessly use-worn. The number of available factory loads in the given caliber is a fairly finite number and, as conceded, some of those may perform mind-blowingly. The number of potential reloads is much, much larger and the chances of hitting the jackpot with one of them are proportionally more attractive.

Benchrest rifle competition has become an enormously popular pastime in recent years and an incalculable amount of ingenuity and research time has been put into working up *gestalts* of rifle and cartridge that will put five holes in the paper at the smallest amount of spread superhumanly possible. The best group I ever fired wouldn't even get me a consolation booby-prize in a sure-enough benchrest match held at the outer fringes of Benchrest Boondocks. But there is one thing that's pretty certain, which is why I've inflicted



Two books by the late George C. Nonte, Jr., give all the pertinent details on how to fashion a number of scarce or unobtainable cases from cases that are more readily available. The book on the right is the newer edition and its listing is more comprehensive.



Hodgdon's H335 powder is a spherical number with which I've had a lot of remarkably successful results in the smaller rifle cartridges such as the .223 Remington. I used 26.0 grains of H335 in the .223 Rem out of the Thompson/Center TCR '83 to dot in a 115-yard group measuring .457-inch between centers.

all this upon your attention: When the ultimate tightness of group is the end-all and be-all of everything, those boys don't use factory loads. What they do is roll their own, with all the arcane savvy they can bring to bear.

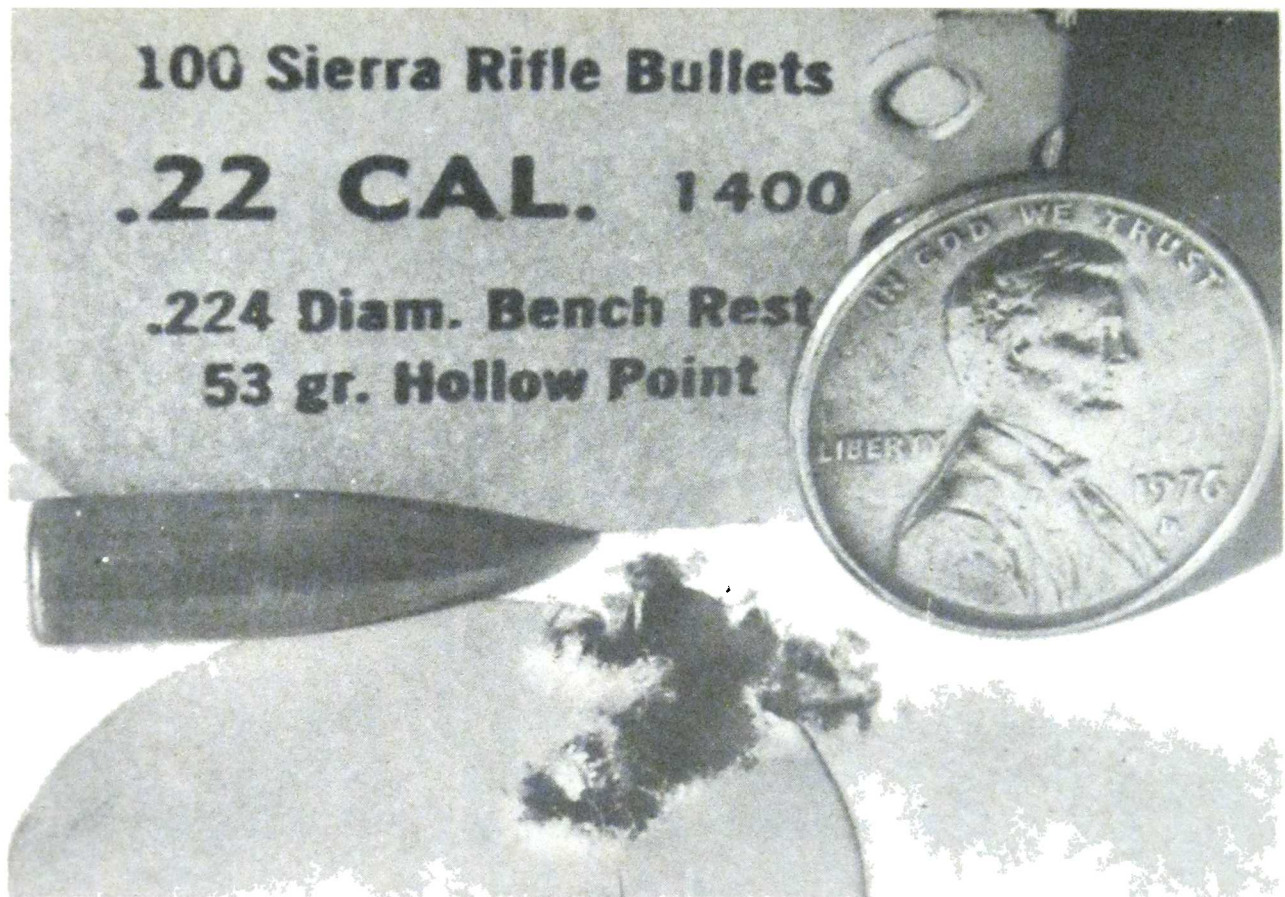
It is possible to achieve accuracy with homemade ammo? Considering the foregoing, why don't you tell me?

THE OTHER FACE OF THE COIN

We've spoken of accuracy and, on the basis of evidence at hand, it appears that reloads do not come off all that

shabbily. There is at least one other pertinent consideration and that is the matter of whether or not a loud noise and a speeding bullet emerge from the muzzle when you put pressure upon the trigger. Under certain specialized circumstances, that can be crucially important.

Let's call that reliability and note that it's of supreme relevance in the example of autoloading firearms. Bring the hammer down on an utter dud in a revolver and all you need to do is give it another double-action (DA) tug to give the next cartridge a try.



This is the group fired from the TCR '83 rifle from 115 yards, with a penny for size comparison.

In an auto pistol, it's another matter, altogether. There are many ways in which inferior ammo can hang one of those up. A totally reliable auto pistol represents a complex equation of kinetic give-and-take between gun and ammunition. Call it a stoppage or be colloquial and term it a jam: By any name, it's the last thing you want. Is it possible to have a jam with factory ammo? My own experience says yes. Are reloads even more apt to pose a problem? Regretfully, that appears to be the case.

At the bottom line, if you're potting tin cans or ground squirrels, it's no big thing. If you're relying upon a gun to

elongate your lifespan, reliability is of supreme importance. There is hardly anything more demoralizing than a diffident click when you really had a reverberating *ka-boom!* in mind.

I've the impression we've already gotten into a JKL or two, and this is only the first chapter. Walk along with me and I hope, by the end of the book, to clear up some of the confusions you may have at this point. It only seems complicated when you're not familiar with the topic. That's an explanation, not an excuse, right?



Here's the light and graceful, but remarkably competent TCR '83 rifle with .223 Remington barrel carrying a 3X-9X Bausch & Lomb scope. When firing this rifle, you need to rest its weight upon the steel receiver beneath the chamber rather than upon the wooden forend to achieve top accuracy.

— WARNING —
THIS PRODUCT CONTAINS LEAD
DO NOT SMOKE OR EAT WHILE HANDLING
WASH HANDS AFTER HANDLING
KEEP OUT OF REACH OF CHILDREN

Printed notice on a bag of Lawrence Brand shot. The warning applies to the handling of anything made of lead.

SAFETY IN RELOADING

Mindful Of The Lurking Pitfalls, The Unincorporated
Munitionmaker Can Enjoy A Long And Placid Career

PAUSING BRIEFLY to knock on wood — for I firmly believe it's bad luck to be superstitious — I will note I've been trying to recall an instance over the past three decades in which I've suffered an injury in the course of reloading.

Once, early on, a friend and I were experimenting with accelerating production by having one operator manipulate the press handle while two sets of hands fed stuff into and out of the press. In an incautious and uncoordinated moment, I managed to get a thumb lightly deprimed. That was about the time we abandoned that approach.

I've collected a few scabs along the way, but have no indelible scars left to show for them. Not too long ago, I could've wound up legally blind except that I had the great, good foresight to be wearing a pair of shooting glasses while casting bullets; an inflexible practice of mine.

Once, long ago, I set up the loading bench on a long session so that I came up off of the stool and operated the press handle, sinking back down after conclusion of the cycle. I awoke next morning with the outraged sacroiliac of all time, but that subsided to a rebellious murmur in a few

days. Apart from that, fairly well home-free and yes, I'm grateful.

I've seen a friend catch the slide off a .380 auto pistol in the teeth, chipping an incisor lightly, but he was firing factory loads, not one of mine and the mishap was due to poor firearm design. The front end of the slide snapped like a frozen carrot. I've blown the head off a cartridge in an M1911-type auto but, again, with a factory load and, thankfully, there was no magazine in place so the blast mostly went down the magazine well, cracking both sides of a really gorgeous set of simulated pearl stocks. My right palm tingled for a bit, and still does when I recall it. There, the fault lay in an experimental conversion barrel relieved not wisely but too well. So it goes.

Reloaders go in harm's way, to some extent. They work with primers and with powder; both considerably hysterical substances, if handled incautiously. If you need to evaluate the innate ferocity of just one lone primer, seat a small pistol type in a .38 Special case. Add neither powder nor bullet. Just put the primed case in a revolver of suitable chambering and hold a single thickness of newspaper about



One should not drink alcoholic beverages when reloading, driving, flying airplanes, playing in a high-stakes poker game and several other activities.

six inches ahead of the muzzle and snap it. The hole left in the paper should prove educational.

The catastrophe to be avoided at any cost is the chain detonation of several primers, all at once and unconfined. The anvil of the primer goes one way, the cup goes another way, each with outrageous vigor. The more primers involved, the more cataclysmic the consequences.

Familiarity breeds contempt; of that, there's no denying. One morning, a commercial reloader set out to make ready for the day's operations. One of the tasks that involved was to empty enough decks of one hundred primers into a three-pound coffee can to get it nearly full. He had performed the chore countless times before. This was the day he did it once too often. With the can nearly full, he



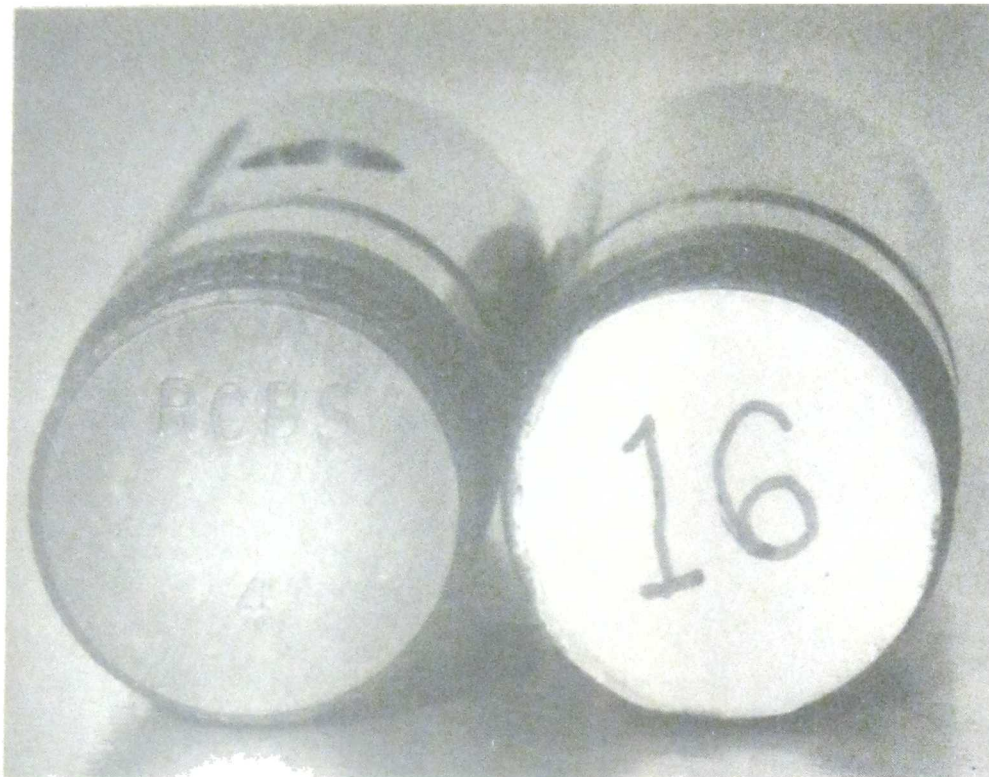
Wear eye protection, such as the shooting glasses seen here, when engaged in reloading and particularly when engaged in casting bullets. Note that the pot has been secured to the bench with a C-clamp to guard against being knocked over to spill its contents.

stripped the sleeve off one more deck, dumped the contents into the can with a sharp wrist-flick and *ka-bah-room!* All the thousands and thousands of primers went off at once and he learned the error of his way with no provision for repentance.

He wasn't wearing safety glasses, more's the pity, and lost the sight of the only two eyes he'll ever have, along with a vast amount of other trauma.

As a persuasively educational illustration, get someone to help, and close your eyes for two minutes by the clock, as counted off by your helper. Toward the end of it, try to imagine what it might seem like if it were all for real and no relief were — uhh, in sight — would you care to encounter the prospect on a no-hope basis? Not awfully likely, right?

Eye protection, when you really need it, can be worth a million dollars, a million-billion dollars, a trillion-quadrillion dollars, on up to the googolplex and beyond. A googol is the figure 1 followed by one hundred zeroes. A googolplex is a 1 followed by a googol of zeroes. Not for a googolplex of googolplexes of dollars would I cheerfully relinquish my fairly emmetropic eyesight. Emmetropia is the happy middle-ground of normal vision between the near-sighted



Numbers on rotors for the RCBS Little Dandy powder measure are not easy to read (left), so I apply a paster to the end and letter the number upon it. Below, the cautionary warning on a sleeve of CCI primers.

myopia and the far-sighted hyperopia.

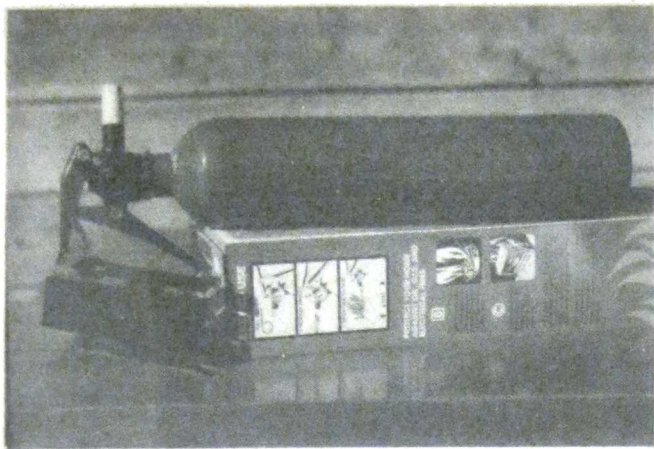
Most people are aware of the need for eye and ear protection when shooting. When reloading, you really needn't bother with the ear muffs or ear plugs but it's an excellent idea to have something tough but transparent between your eyes and what you're doing. As was noted, that's exceptionally true when casting bullets. Even a tiny drop of water causes molten bullet alloy to erupt with volcanic violence and the spatters can carry a long distance. Make certain there are no exposed powder or primers in the remotely possible fallout area of the casting operation. A flying drop of lead can set off powder at a considerable distance and there are recorded instances in which it has done just that. The consequences were most unfortunate.

Make sure you know what you're decanting into the top of the pot when the alloy needs replenishing. On the occasion mentioned previously, I decided to recycle a bunch of cast bullets that had been on hand for some time. They'd been lube/sized, but that was not the problem. Apparently a live .22 short cartridge had fallen unnoticed in among the bullets and gotten buried. Within less than a second of dumping the bullets in, something went bang and molten alloy rose in a silvery geyser. Cleaning up later, I found a spent .22 short case — with no visible firing pin indentation on the rim — from which I deduce the probable cause of the calamity.

Many say you should wear long-sleeved shirts, button your shirt collar and some go on to advocate wearing welder's gloves. If you care to do so, it surely hurts nothing. My usual costume whilst working at the uhh, casting couch is a pair of jeans, a short-sleeved shirt open at the throat, and a pair of shooting glasses. The footwear is a pair of motorcycle boots, with the cuffs of the jeans outside the tops.

Once, long ago, I was casting bullets with the alloy con-





Keep one or more fire extinguishers in the reloading area. Make certain they are suited to cope with any type of fire apt to occur. As a regular routine, make it a practice to "go for" them in simulated drill.

tained in an old frying pan atop the electric kitchen range. My footwear at the time was a low-cut pair of bedroom slippers. Picking up the pan by its handle, the steel shank rotated a bit within the wooden part, sloshing a fair amount of molten alloy onto the linoleum. Some of it ended up inside one of the bedroom slippers. It was — quite obviously — an unforgettable experience.

Long since, I've come to consider bullet casting as an outdoor type of activity. You need ventilation and lots of it. The fumes are hazardous if inhaled and may cause lead poisoning. Any lead or lead compound that finds its way into the system is eliminated very slowly, if at all. Besides inhalation, you should avoid smoking, eating or any other activity that can transfer lead from fingers to mouth, when working with lead and that includes seating cast bullets, lube/sizing and similar activities.

As a rule, the blood test you get during a periodic physical checkover at your family physician does not assay the lead content in your blood, if any. That requires a separate, specialized and fairly costly test. If you've reason to sus-



Shown both closed and open, here's an example of a handy wooden storage container for smokeless powders. With the handle on top, it can be quickly and easily evacuated from an area in case of fire or emergency.

pect you have a problem with excess lead in your system, discuss the matter with your doctor.

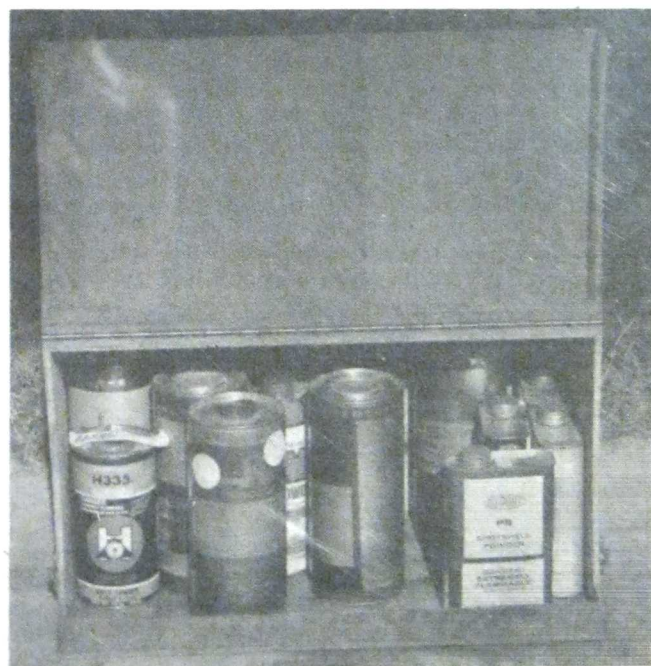
Black gunpowder and its latterday substitute, Pyrodex, burn with extreme rapidity, once ignited. It's termed a *flare* and it's barely short of a full-scale explosion. Smokeless or nitro powders burn more slowly when unconfined, but they still burn quite vigorously and can pose a severe fire hazard to nearby flammable materials. For obvious reasons, you take pains not to have uncovered quantities of powder about.

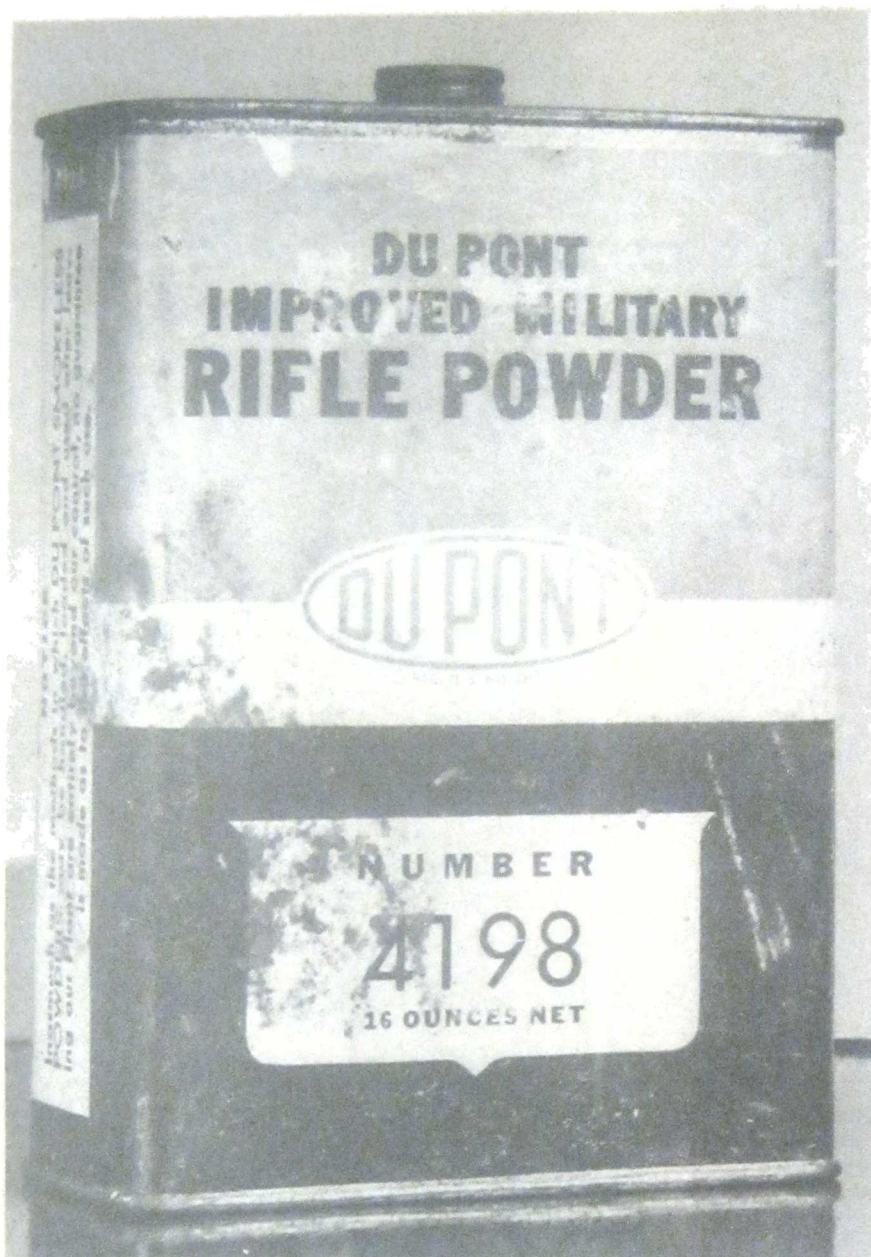
Smoking while casting or handling bullets poses a toxic threat. Smoking while working with powder and primers is just plain stupid; indefensibly so.

When set off under close confinement, with no way to vent or expand, black gunpowder will develop a peak pressure on the order of 85,000 pounds per square inch (psi). Smokeless powders, as a class, go to around 210,000 and the compounds used in primers to more like 400,000 psi. The figures are quoted from an old work of General Julian S. Hatcher's *circa* the mid-Thirties. He used psi as the unit of measurements because copper units of pressure (c.u.p.) was not adopted until forty-some years later.

If your reloading facility is contiguous to your dwelling place, as is often the case, it is wise to make provisions against the possibility the house could catch fire, with the blaze spreading to the area where you store powder, primers, loaded ammunition and possibly other critical materials such as paints, solvents, lighter fluid and the like. With that in mind, I like to keep my powders and primers in lightweight wooden containers with handles so as to facilitate speedy evacuation in the event of fires or similar emergencies.

At one time, I used to store powders in an old refrigerator whose cooling system no longer functioned. Being insulated, my theory was that it would protect its contents from critical temperatures if a fire should occur in the area.



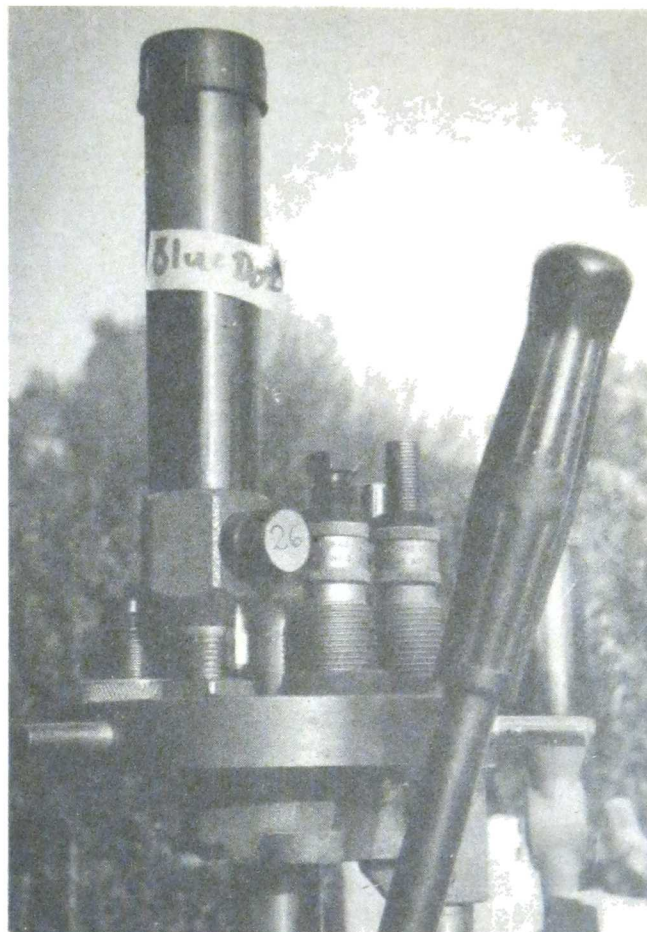


At left, a rather extreme example of keeping powder on hand too long! If you fancy retaining picturesque old containers as collector items, use up the contents or discard them. Oddly enough, this Thirties-vintage IMR-4198 still performed quite well in the early Eighties. Below, dating the carton makes it simple to use up your old stock first, always a good idea.

It never did and I'm grateful for that, but I came awfully close while still living in that house. I left an electric casting furnace unattended for a short while, returning to find its cord had shorted out, burned free and fallen upon a piece of corrugated cardboard, which was commencing to burn cheerfully. I put it out and have made it a practice since that time to avoid leaving electrical equipment unattended. Things such as casting furnaces, case tumblers and the like are either supervised or operated in places where they can't start fires if something goes wrong.

It's poor policy to store primers and powders in the same storage facility. Primers are quite stable in storage, as noted. It is possible for a quantity of powder to deteriorate to the point of spontaneous combustion, provided it was left with a high residual acid content at the time of original manufacture. If stored in substantial bulk, powder is considerably less stable than if stored in containers holding one pound or less. Deterioration, if it takes place, is accelerated by high ambient temperatures. That's to say it's a





The RCBS Little Dandy powder measure is an extremely handy affair, available with twenty-six different fixed-cavity measuring rotors. Note here the tape label on the reservoir tube, identifying contents, and the small colored stickers on the end of the rotors, designed to make the rotor number much more visible.

poor idea to store quantities of powder up in the rafters above your garage if it gets extremely hot up there.

Mark the date of purchase on powder cans and use up the oldest supply first in a given make/number of propellant. Check your stock twice a year, opening the container and taking a sniff of the contents. Deteriorating powder has a distinctive acid reek unlike that of healthy stuff. If decanted, spoiling powder usually displays a reddish-brown cloud of dust. If encountered, discard that lot of powder by flushing it down the toilet.

You can get into a lot of big, bad trouble by improper identification of reloading components. Away from its labeled container, a number of powders resemble several other powders with deceptive plausibility. With only a few exceptions, it's all but impossible to tell one given primer from another, once they're dumped out of their original labeled container.

There are a few powders that can be confused with each other, even if left in the container in which they were shipped from the original maker of the powder. One such example is Hercules Red Dot and Hercules Blue Dot. Both come in canisters that are predominantly blue and of nearly the same shade. If the primary label faces away from you, it's easy to confuse Red Dot with Blue Dot. It has happened, and to a reloader of many years experience. My solution to that is to affix a number of self-adhesive red

1¼-inch pasters to the working can of Red Dot so as to be clearly visible from all sides.

When I put powder in the reservoir of a powder measure, I tear off a short piece of white drafting tape, put the type of powder on it with a felt-tipped marker and affix that to the reservoir, along with the date. By that means and *only* by that means can I feel reasonably certain what powder is in the measure. One should not leave powder in the measure after making up the loads at hand. If you forget to label, or if any doubt whatsoever exists, be cold-blooded and flush the suspect powder down the toilet, making earnest resolutions to avoid such problems in the future.

They tell you not to deprime cases carrying live primers and there is solid justification for that warning. I have modified my old RCBS A-2 press — still in extensive service since early 1959 — by making a collar of sturdy aluminum tubing to cover the open front of the ram. If I have to decap a live primer, I do it in the A-2 with the collar installed. I also take pains to be wearing safety glasses when doing so.

A live primer, once decapped, should not be used again. They can be deactivated by soaking in common automobile engine oil — drained crankcase oil works just fine — and buried in the ground by way of safe disposal. Engine oil will fairly well inert — if I may use that as a verb — both powder and primers; a good and handy bit of information



Hercules Red Dot and Blue Dot powders both come in containers of about the same shade of dark blue. If seen from the back, they can be confused, and have been. By applying bright red pasters, as at left, the Red Dot is much easier to identify and, being faster-burning, needs such identification.

to keep in mind against possible time of need. Give it plenty of time to get its disabling work accomplished; two or three days is none too much.

Reloading generates some amount of sensitive rubbish that should not be put in the trash barrel out in front of the house for collection on garbage pickup day lest the neighborhood small-fry retrieve it and hurt themselves, with resulting lawsuits by their parents. My solution to this is to keep an old, empty Prestone jug beneath the loading bench as my Deep-Six receptacle. When it gets full, I pour in some crankcase drainings, let that age, cap it snugly and bury it in a suitable place.

Reloads should be made up after thoughtful consultation of one or more sources of load data. It is deceptively easy to look up data for the wrong cartridge. For example, you can look up data for reloading the .300 Winchester magnum and end up with the section for the .300 Weatherby magnum. Both designations start with the letter W and are of about the same length. I own a rifle in .300 Winchester magnum and adore it rather intemperately. I have never owned and do not have any expectations of ever owning a rifle in .300 Weatherby magnum. The loads for the Weatherby are hazardous if put up for the Winchester magnum. Accordingly, when a new book of load data turns up, I

underscore the section for the Weatherby magnum vividly with a red felt-tipped marker to sort of guarantee to get my attention and avoid inadvertant incorrect consultations.

That is an example of ruefully conceding that anything that can go wrong will go wrong and things that can't possibly go wrong will also go wrong. Many refer to that as Murphy's Law, but the truth, it turns out, is that Murphy didn't even set it down. It was done by another man of the same name...

The National Reloading Manufacturers Association (NRMA) can be reached at 4905 S.W. Griffith Drive, Suite 101, Beaverton, OR 97005 and they will send free upon request, small but pertinently helpful brochures entitled: *The Basic Rules For Reloading Safety*, and *Properties & Storage of Smokeless Powder/Sporting Ammunition Primers*.

The brochures on powders and primers were produced by Sporting Arms & Ammunition Manufacturers Institute (SAAMI). I recommend that you request, obtain, study and follow the recommendations in these brochures.

As I've pointed out in other discussions similar to this one, a guiding precept of mine is, "Never give a negative order." Jocosity aside, here are some things to avoid:

Never try to salvage powder from loaded ammunition or

ADDED PRECAUTIONARY MEASURES

- Keep container tightly closed when not in use.
- Avoid friction and rough handling.
- Do not carry in clothing.
- Do not take internally. In case of ingestion, cause vomiting by putting fingers down throat. Call a physician.
- Prevent contact with food, chewing material, and smoking material.
- Do not smoke or approach heat or flame source while wearing clothing contaminated with smokeless powder.
- Wash thoroughly after handling.
- Consult SAAMI bulletin* for properties of smokeless powder.

ADDED STORAGE PRECAUTIONS

- Consult SAAMI bulletin* for storage of smokeless powder.
- Store only in Department of Transportation-approved containers.
- Do not store in same area with solvents, flammable gases, or highly combustible materials.
- Do not subject storage cabinets to close confinement.
- Obey all regulations regarding quantities and methods of storage.

DISPOSAL

- Do not keep old or salvaged powders.
- Check old powders for deterioration regularly, using procedures in SAAMI bulletin.* Destroy deteriorated powders immediately.

*SAAMI Bulletin 1174-10M, Sporting Arms & Ammunition Manufacturers' Institute, Inc., 420 Lexington Avenue, New York, NY 10017

Printed in U.S.A.

Most powder containers, such as this one from Hercules, carry extensive warnings about safe storage and handling. Study such listings and follow the sensible suggestions given.

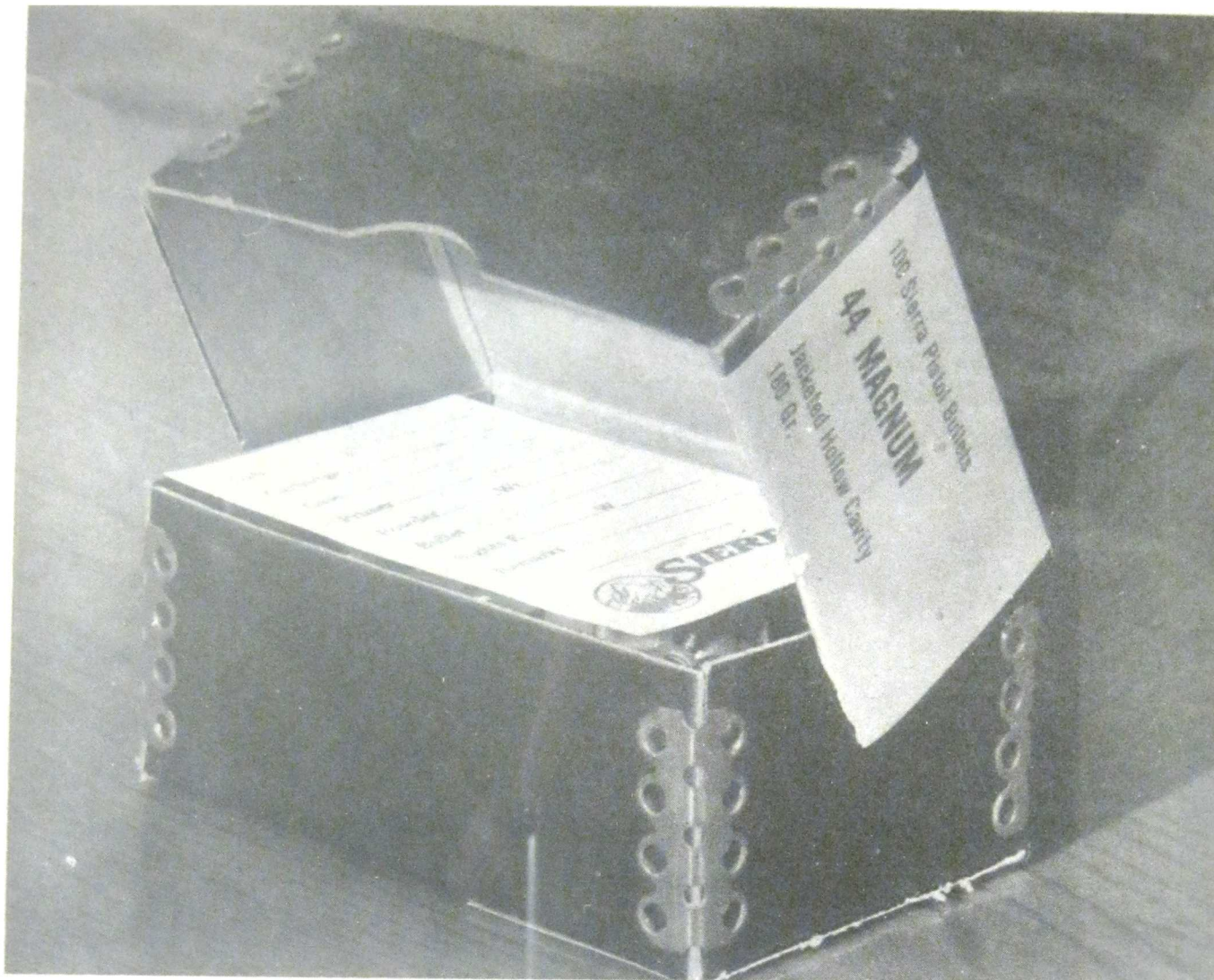
use it for making up other reloaded cartridges. Most if not all factory ammunition is made up with non-canister powders and any load data available to you does not apply to them.

Never mix one powder with another powder within the same reloaded cartridge. One term for such things is a "duplex" load. Their performance is erratic and highly hazardous. I note this because I'm fully aware how easy it is for an ingenious reloader to arrive at the concept independently and decide to try it out. *Don't do it!*

Never-never attempt to utilize the powder loaded in blank cartridges for reloading other cartridges; not even for reloading blank cartridges! In special particular, I refer to the center-fire blanks in military rifle calibers, as used by veterans' organizations for firing salutes at funerals and the like. Figuratively — not literally — the powder used in those is pure dynamite and many a fine rifle and unwitting experimenter have been damaged by their injudicious use.

Store and dispense powders and primers only in the original containers and do not repackage either of them. Take particular pains to avoid placing either powder or primers in glass containers. The reason for that is simple: It is possible for direct rays of sunlight to be concentrated somewhat in the manner of a burning glass, creating enough heat to set off highly flammable materials. It is not only possible, but it has happened. Avoid letting it happen to you!

Down the years, various items of reloading equipment have been provided with primer feed tubes for automated primer seating. Usually, these are of thin-walled brass; sometimes of aluminum. Any time you get a tall stack of primers rubbing against each other, you have a potentially dangerous situation. If one goes off, they all go off, with no detectable delay and with violent consequences. That can happen if the loaded tube is dropped — as can happen all too easily — or it can happen in normal, routine use in the manner intended. It seems that dusty residues of the prim-



As we've noted, lead is a hazardous substance when taken into the system and it's eliminated slowly, if at all. Many manufacturers of bullets include a few gummed load data labels in the box of bullets, as seen here. As most such bullets have some amount of exposed lead, the lead tends to rub off onto the back of the label and, if you lick the label with your tongue, you get a small dose of lead in so doing. Personally, I never use such labels but, if you feel a strong urge to use them, it's better to moisten the gum with a damp sponge or the like.

ing compound can come off and build up in such feed tubes, due to vibration, creating one of the obvious hazards. If you feel you must use such devices, clean them periodically, preferably between fillings, and handle with extreme care. My own choice is to avoid them, except for the one on the Dillon press, with its outer guard tubing of heavy steel.

Cartridges with the bullet seated abnormally deep will develop substantially higher peak pressures when fired. You can encounter problems with that if, for example, you're loading cast bullets and small amounts of grease come off each of the bullets to build up in the seating stem, forcing the bullets progressively lower as it accumulates. Check the cartridge's length overall (LOA) periodically and remove the seating stem for cleaning away the accumulated grease, if necessary.

Admittedly, it has no direct bearing on reloading but I'll mention another hazard in the form of small rimfire revolvers whose cylinders come out for ejecting the spent case and loading with fresh rounds. If such a cylinder is dropped to a hard surface, such as a concrete sidewalk, and lands on the rim of a live round, it is highly apt to set off the cartridge and the bullet will come out of the front of the cylinder with ample velocity to be lethal. Recorded instances of that have happened. It's just one more of the unlikely hazards of which you should be aware so as to avoid the consequences.

I have long made it an inflexible practice to verify that the bore is clear and free of obstructions before firing. In particular, I do that before the first firing of any new gun. The practice antedates an incident in the early Sixties when a test rifle was shipped to me by another gun writer so

I could do a number on it in my turn. I removed the bolt, took the usual keen squint up the bore and beheld inky darkness. Checking, I discovered a jacketed bullet, solidly lodged in the bore, about one inch ahead of the chamber: just where it could wreak maximum mischief, had I innocently made up a round and fired it! I can assure you it made me damned glad I'd checked. I've been checking ever since and haven't encountered another blockage to the present, but I plan to keep on doing it. I suggest you do the same.

Overloads — those exceeding specifications in reliable manuals and handbooks — can be dangerous and, under certain circumstances, underloads can be likewise. Some powders do not respond well to substantial amounts of air-space between the top of the powder charge and the base of the bullet. Winchester 296 is but one of those. Winchester is quite specific that their loading recommendations be followed implicitly. If you cut the charge of W-296 much below what they say, the load may fizzle, leaving the bullet lodged in the barrel: an obvious hazard if you happen to be in rapid-fire mode with a revolver. Much the same observation applies to Hodgdon H110 powder and I don't wish to seem to be bad-mouthing either of those excellent propellants because they are two of my personal favorites, when employed correctly. Further discussion of the finer points of that are scheduled to appear in the chapter on bullet seating, which should be Chapter 11 if we don't depart from the original outline.

Slow-burning rifle powders are reported capable of hazardously erratic behavior if loaded below customary charge weights, with substantial amounts of internal air-space. It's never happened to me but then I've hardly ever made up and fired such loads. Some say it can't happen, proving solely that — like me — it's never happened to them. I mentioned all this in an earlier edition of ABC/R and received a manifestly sincere letter from a reader who said it did happen to him. Regrettably, his letter is not readily at hand for verbatim quoting. The point remains: It is unwise to depart from load data as supplied in reliable manuals

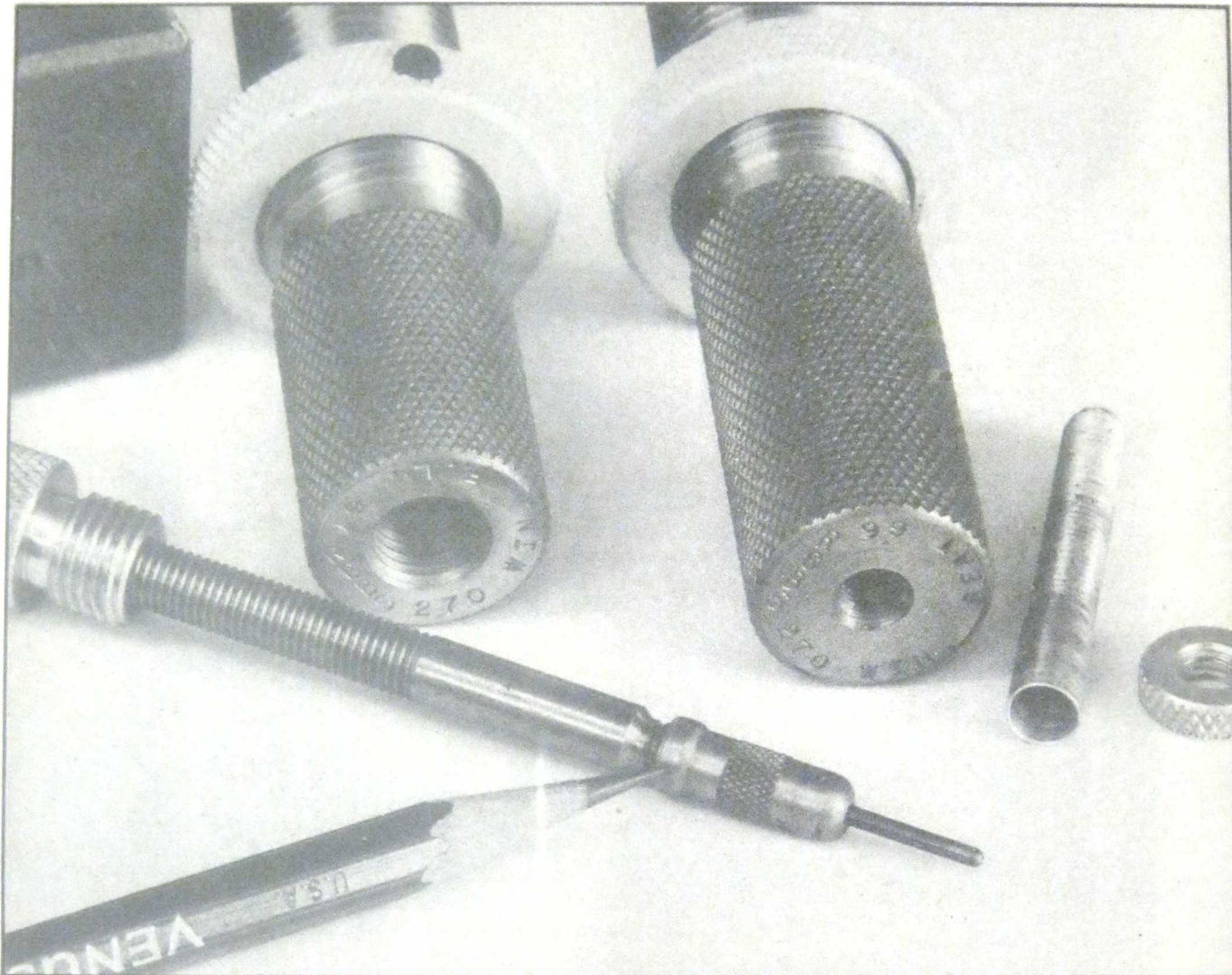
and handbooks. That applies, regardless of the direction in which you depart.

The nagging thing about putting down any discussion of hazards and pitfalls such as this one is the awareness of the stark impossibility of compiling and cataloging absolutely every single thing that can go wrong, along with the means for craftily avoiding it. *No such representation is made or implied here.* For but one example: Up to this point, I've made no mention of the possibility that a black widow spider might lurk in the container where you store spent cases and bite you upon the incautious fingertip. Yes, beware of that, also, and of any and all other unspecified dangers, as well.

What I've tried to do in this chapter is to foster and instill an instinctively wary attitude upon the part of the individual reader. I'll give you yet one more example: Most of the major bulletmakers, in an effort to be helpful, include a few gummed labels in with their boxes of bullets, nicely printed so you can fill in the pertinent details, lick the back and affix them to the box of reloads you make up. It's never been my custom to use these labels and I usually pluck them out of the freshly opened box and chuck them in the wastebasket. One day, it finally occurred to me why I do that. I noticed the gummed side was well blackened with lead smears from the exposed soft points of bullets jostling against it during shipment and handling. Lick that with your tongue and some given number of micrograms of lead enter your system. We've discussed the hazards of that.

That, *amigos y amigas*, gives you the broad picture of safety in reloading. You need to study the foregoing for the sake of familiarizing yourself with the obvious hazards and how to avoid them. But don't stop there: Go on and keep a safety-conscious eye peeled as you look about your own facilities and operations. Identify the further potential hazards and figure out how to avoid those, also. Keep one or more suitable fire extinguishers in or near your working space and stage occasional drills in which you visualize imaginary emergencies and how best to cope with them.

At the bottom line: Never make the same mistake, even *once!*



Above: Disassembled die set in .270 Win. Pencil points to the collar of the expander plug. Seating punch for seating die at right. (Below) One of many shell holders, this one for .222 Rem and others.



GETTING STARTED

YOUR BASIC essentials and procedures will vary somewhat, depending upon the cartridge you are reloading and, to some extent, upon the gun in which they were or will be fired.

The basic starting procedures for shotshell reloading will be discussed in the chapter dealing with shotshells. For the present, we're looking into the reloading of more-or-less straight-sided cases, such as the .38 Special, and we'll get to the bottlenecked cases after that.

Helpful Notes And Comments On The Mechanics Of Setting Up And Getting Into Production

STRAIGHT-SIDED HANDGUN CARTRIDGES

A properly made-up cartridge needs to have its mouth gripping the sides of the bullet securely and, when that is true, the cartridge will have a few thousandths of an inch of clearance between the case walls and the chamber, so as to permit easy chambering.

When the cartridge is fired, the high-pressure powder gas expands the case outward until its expansion is stopped by the contact with the chamber. Being somewhat elastic, the case usually springs back slightly after gas pressure has subsided, thus permitting easy extraction of the fired case.

As a usual rule, the mouth of the fired case will have expanded enough to permit the base of a bullet to be inserted easily and pulled back out just as easily. Obviously, one of the things we need to do is to re-establish the tight grip of case mouth against bullet base.

At the same time, we must expel the spent primer from the previous firing, install a fresh primer, add a suitable charge of the proper powder and seat the new bullet. In simple essence, that is about all there is to it, with a few other steps that will be discussed as they come up.

One of the things you'll discover, rather early, is that some amount of variation exists between cartridge cases. Those from a given box of factory ammo usually are quite uniform, but the differences from one make to another are significant. For example, not all cases of a given caliber designation are equal in thickness of the metal at the case neck.

In order to cope with such a state of affairs, the makers of reloading dies dimension the sizing die so that it makes the inside diameter (ID) of the case neck just slightly smaller than it needs to be. After the case has been pressed up into the sizing die and withdrawn by the powerful leverage of the loading press, it is given a pass over an expanding plug to enlarge the neck ID to the desired dimension; usually two or three thousandths smaller than the diameter of the bullet base. This is done to provide the desired friction-fit, so as to hold the bullet securely in place.

At the same time, it is desirable to flare the case neck slightly to ease the operation of commencing to seat the bullet base. Jacketed bullets require only a slight amount of flare at the case neck. Cast bullets of lead alloy require somewhat more of the same funnel-effect, to minimize scraping and distortion of the softer metal when the bullet is being seated.

After the bullet has been seated to the correct depth, it is necessary to turn the neck flare back in so as to make the cartridge easy to chamber. That is known as crimping the mouth and there are two basic types of crimping: roll-crimping, which puts a distinct turned-in radius at the mouth and taper-crimping, which leaves the side of the case pretty much a straight line.

Having sketched out the general nature of the operation, let's go back and take up the several steps in greater detail.

First, we inspect the fired cases we propose to reload. If they are mixed as to brand, it is a good idea to sort them into the various categories, as identified by the headstamps. That's the little group of letters and numbers appearing on the head around the primer. As you're doing that, make certain there is no foreign matter inside the case, either by visual examination in good light or by inverting the case and tapping the mouth lightly on the work surface.



This is a 222 Rem case resting in the #16 RCBS shell holder shown on facing page. Lower flange fits into the top of the ram on the reloading press.



RCBS resizing lube, with a view of instructions appearing on the back.



Watch for case defects that can cause problems. These include split necks, dented or mutilated case mouths, battered rims and so on. A pronounced line extending all or part of the way around the case, parallel to the head, means the interior of the case has been stretched and weakened and there is a chance the case may separate at the next fir-

ing to leave the front portion in the chamber as the head end is extracted. If detected, cull out such cases and crush the mouths in a vise or with a pair of pliers to keep them from being used.

At this point, it is assumed you have some manner of loading press, securely fastened to a sturdy bench or similar work surface. You have a set of loading dies in the appropriate caliber plus a shell holder to fit the case with which you're working. You have primers of the suitable size and type, some powder, one or more manuals or handbooks on reloading/handloading, a means for dispensing powder charges and a reloader's scale on which to check the charge weight, some bullets of the desired diameter and weight and, of course, the empty cases which may be virgin or fired some given number of times previously.

You will also want to have some case resizing lubricant, perhaps an uninked rubber stamp pad so you can smear a bit of lube on the pad and roll the cases across it to apply a thin, uniform coating of lube to the brass.

The exception here is if your resizing die has an insert of tungsten carbide. It is unnecessary to lubricate cases for resizing in carbide dies. It is quite important to do so with dies of hardened steel. Carbide dies are identified as such by stamping on the head or side of the die body. If in doubt, lubricate!

Install the shell holder in the slot on the ram. Usually, these just turn in and are held in place by a snap-ring arrangement. In some machines, it is held by a hex-socket screw or some other arrangement. The press should have been accompanied by an instruction leaflet that spells out such details. The same helpful booklet will also cover the procedure for seating the primers, which varies between makes and types of presses. If, for some reason, you have a press, dies and no instructions, write to the firm that made the press. Most will send a fresh booklet on the house, or will ask for a modest sum to supply a copy. It is an excellent investment if the latter is the case.

With the shell holder installed, operate the press handle to run the ram to the top of its travel and, leaving it at that point, turn the resizing die down into the head of the press until it makes snug contact with the top of the shell holder. Move the handle slightly, adjusting the die as needed to achieve a distinct but not arduous "kiss" of the holder



Both sides of the tube containing Lee Precision lube, which can be used "in the wet," or after allowing it to dry. Huntington lube is from Huntington Die Specialties.

against the bottom of the die. At that point, hold the die in its setting and secure it in place by snugging down the locking ring of the die against the head of the press. Most such locking rings have a set screw or perhaps a neoprene O-ring to hold them in adjustment and you may wish to set the locking ring to speed up installation of the die in future operations.

It should be noted at this point that there is some variation in the way the different makers of reloading dies arrange things. Some provide a decapping stem in the sizing die, while others incorporate the decapping pin in the end of the expanding plug. Either approach will be clearly apparent as you examine the die(s).

With the die installed and adjusted as described, insert the rim of the case into the shell holder, making sure it's all the way to the rear and — using due care and caution — operate the press handle to bring the case mouth up into the hole at the bottom of the resizing die. Most such dies have but modest throat to steer the case mouth into place and if you do it too hastily, you can snag the mouth and ruin the case.

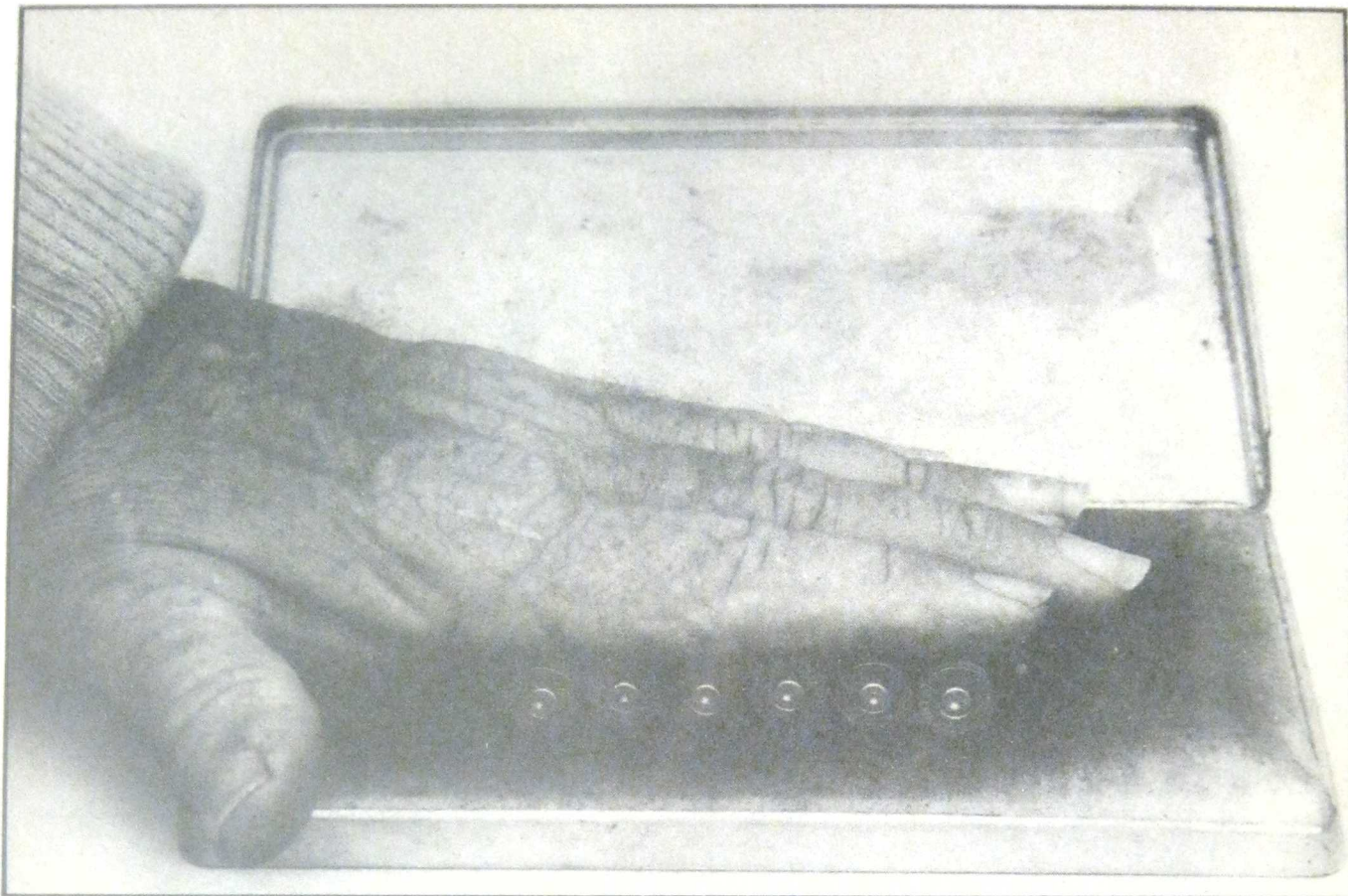
With the mouth suitably in place, exert more force against the press handle and the case should be pressed up into the resizing die. Continue to the limit of the handle

travel and take a thoughtful look at the state of things. The case should be out of sight and the top of the shell holder should be in snug contact against the bottom of the resizing die. If you can see a crack of daylight between them, you need to turn the die on downward slightly.

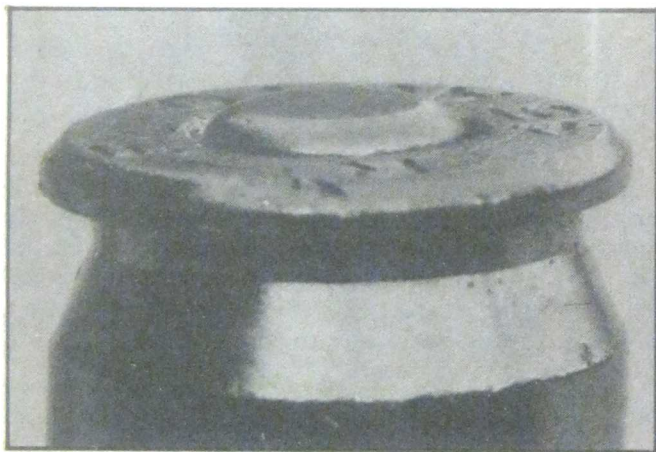
Reverse the press handle, apply force the other way and the case will be drawn back out of the resizing die. At the same time, as noted, the old primer may have been pushed out by the decapping pin. Dispose of the spent primer suitably if the press didn't do that for you. If you don't, you'll be ankle-deep in retired primers before long.

If the press is of the turret type, rotate the turret to bring the next die into position. This is the mouth-expanding die — with or without decapping pin — and you install it so as to just barely put a flare in the case mouth, checking by inserting the base of a bullet into the mouth after expansion. Take pains not to flare the mouth more than the minimum amount necessary. Excessive mouth flaring shortens the useful life of the case by accelerating split necks.

By this time, the old primer will have been pushed from the pocket and you'll need a fresh one seated before proceeding much further. The fine aspects of primer selection and seating will be covered in another chapter. Primers



A convenient way to apply case resizing lube is to put it on an uninked rubber stamp pad and roll the cases across it. This works great for straight-sided cases, but avoid getting excessive lube on the shoulder of bottleneck cases because that will result in unsightly dents in shoulder.



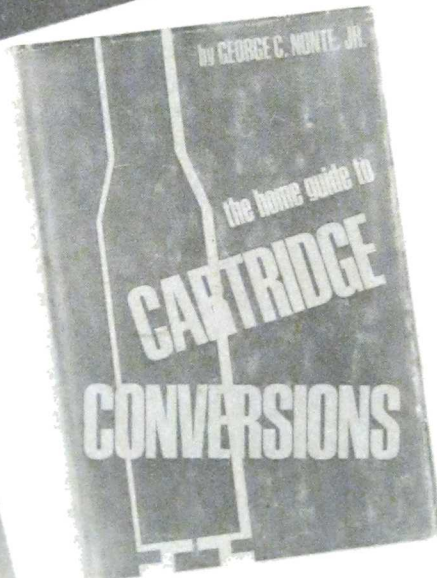
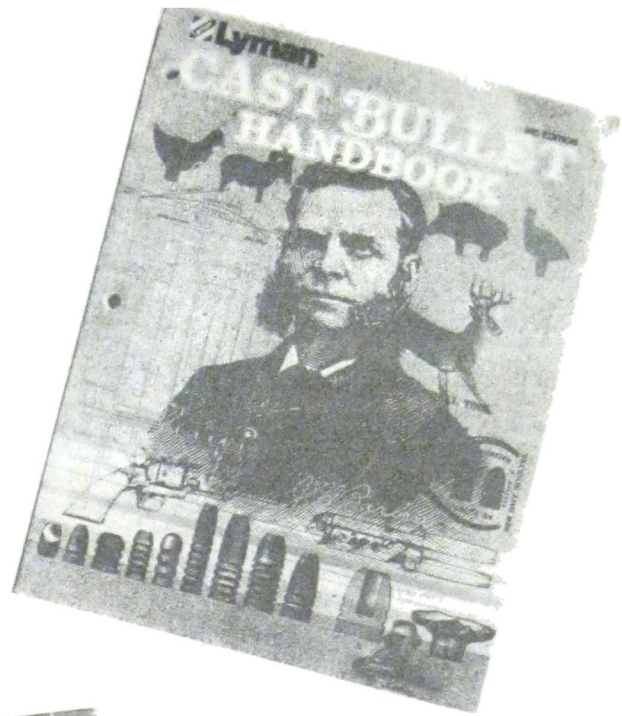
A .45 ACP case demonstrating insufficient seating of the primer. Face of the primer cup wants to be flush or slightly below the rest of the case head.

come in two diameters — .175- and .210-inch — as well as for rifles and pistols. The distinction between the last two is that pistol primers have thinner cups for easier ignition under the light hammer-blow typical of pistols. Rifle primers have thicker cups to better withstand the considerably higher peak pressures typical of rifle loads.

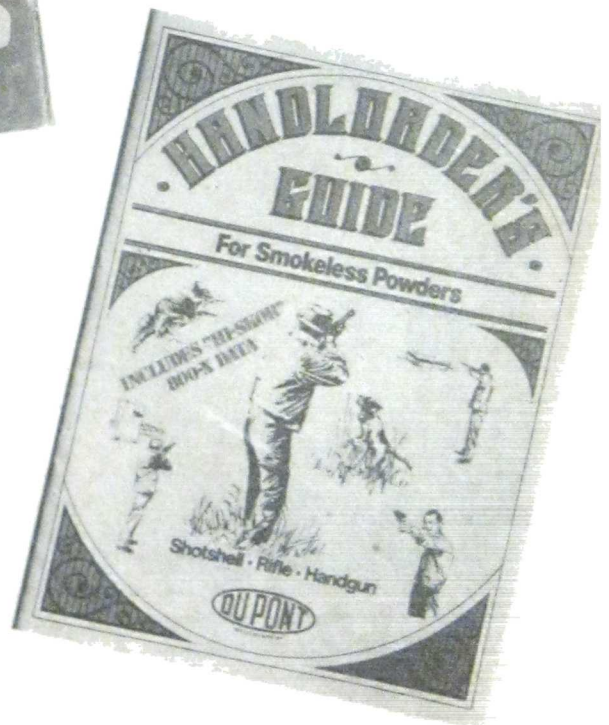
The primer needs to be seated firmly into the primer pocket, so its cup does not protrude above the surface of the case head. That would be apt to interfere with cylinder rotation in a revolver, for example, or it could cause premature ignition in an autoloading pistol. At the same time, the primer should not be seated with such excessive force that its cup shape is distorted and flattened in visual comparison to an unseated primer of the same make/type. Needless to say, it wants to be seated with its cup exposed and its open end toward the powder charge!

With the primer seated, we've got at least one load-ready case. If your press is not a turret-type, you will have sized all the cases, replaced the sizing die with the expanding die and expanded all the cases, going on to seat the primers.

The next step is to pore over the book(s) of loading data and select a suitable weight of an appropriate powder, bearing in mind the caliber of the cartridge and the weight/type of bullet you propose to load. Having settled upon that, make use of dipper-type measures, fixed-rotor measures, or adjustable-rotor measures to dispense one suitable charge of powder into each case. You want *at least* one such charge. *You do not want any more powder than just that much!*



These are examples of the sources of reloading data, which need to be consulted before making up a reload.



The powder-dispensing system should be checked for accuracy by use of a reloader's scale. I like to make such checks by dropping ten charges, all together, into the pan of the scale, weigh the result and divide by ten. If ten charges weigh 31.5 grains, your average charge is 3.15 grains and so on. At the same time, it is an excellent idea to drop a single charge into the pan, weigh that carefully — recording the weight for reference — return the test charge to the container and do it a few more times. That's by way of finding out how close each individual charge comes to what you've hopefully established as the average drop. In our example, each charge should come out quite close to 3.1 grains. If any come out at 2.7 or 3.3 grains, for example, you have a problem in your powder-dispensing system and it needs to be corrected before you go on to load up a big batch of ammo.

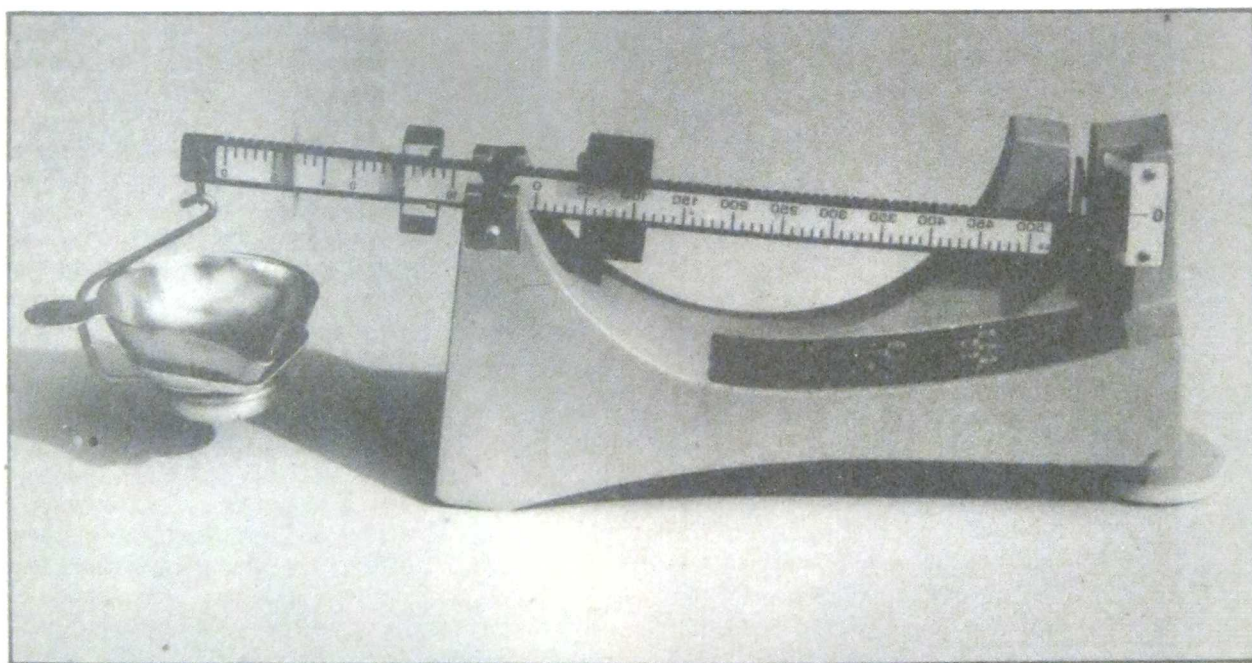
As I've said before and undoubtedly'll say again, I like to get my sized, mouth-flared, primed (load-ready) cases all set up and either put them into a loading block before I add the powder charges or add the powder charges and then set each charged case into the block so I can make a keen and thoughtful visual verification of the uniformity and appearance of the powder charge in each case before I go on to seat the bullet and crimp the case necks. This absolutely does wonders for my peace of mind and my confidence in the reliability and probable safety in firing the resulting cartridges.

Having been inspected and block-checked, I set a bullet in the mouth of each and go on to seat them, one at a time. Depending upon the cartridge, the bullet and the seating die at hand and in use, it may be possible to seat the bullet and crimp the neck all in one pass. Bullet seating involves enough complex and vital factors that I've allotted it a chapter all its own in this edition.

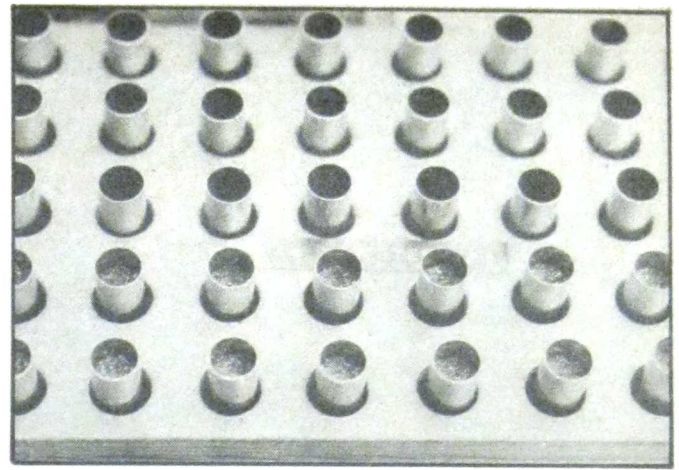
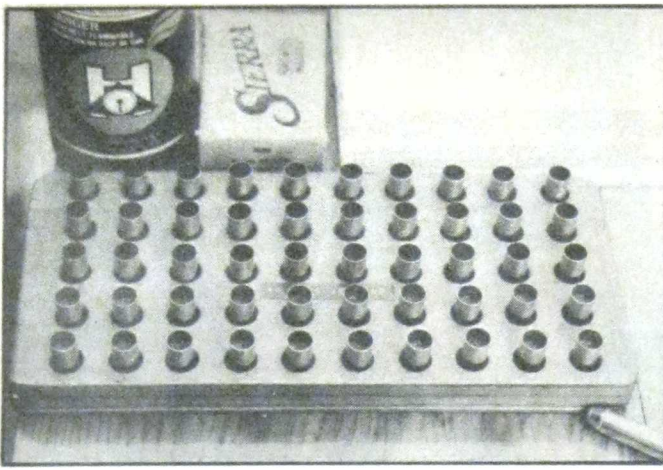
For the moment, it's fairly obvious that the overall length should not be so great that the nose of the bullet juts out ahead of the front face of the chambers in a revolver cylinder. In auto pistols, the completed cartridge has to be short enough to fit down inside the magazine. The auto pistol also requires that enough of the bullet remain ahead of the case to guide the round up the feed ramp and into the chamber smoothly. A bullet seated a lot deeper than is normal, natural and customary can and will boost the peak pressures developed at the time of firing; even slightly deeper seating raises the pressure proportionally.

Rather frequently, I seat the bullet as one step and then go back and take care of the case neck as a second operation. It takes added time, it's true, but the results may justify the extra bother. If I think they will, I take the trouble. I try to be that type of reloader and I remain convinced it's the way to go.

The typical seating die consists of an outer body with its locking ring plus a seating stem, also with its smaller locking ring. The seating stem usually is contoured to handle



A reloader's powder scale, such as this one from RCBS, is one of the basic-basic necessities for successful and trouble-free reloading. This is RCBS' Model 505, with 505-grain capacity.



I like to set my load-ready cases up in a reloading block, such as this homemade one and put the powder charges in place. Here the front two rows have been charged, making it an easy matter to visually examine and check the levels of each charge for uniformity before seating bullet.

one or more bullet nose profiles and seating stems designed to handle various bullet designs usually can be obtained from the maker of the die, or from the local dealer handling that brand of dies. It is important that the bullet be seated and the reload completed without severe damage or mutilation to the exposed portion of the seated bullet. Poor performance is the penalty if you don't attend to that.

The procedure for setting up the seating die runs about as follows in a typical instance: Put the charged, load-ready case — with or without the bullet in place, as may be convenient — into the shell holder and run the ram to the top of its stroke by operating the press handle. Loosen the locking ring of the seating stem and move it up in the die several turns. Turn the die body into the press head and keep on turning it down until you feel the crimping shoulder make contact with the case mouth. At that point, turn the die body back up perhaps one-eighth-turn or so and snub it at that setting with the die body locking ring.

Then work the handle to drop the ram enough to put the bullet into the case mouth, run the ram back up and commence turning the seating stem down until you feel it touch the nose of the bullet. You may have to raise the stem higher to accomplish that.

What you're trying to do is to start seating the bullet into the case neck, *just a little distance*. You establish you've done so by backing the ram down and looking at the progress of the seating and you also feel it being seated as you work the handle.

Continue turning the stem down, a little at a time and stroking the press handle until you get the bullet seated to just exactly the depth you had in mind.

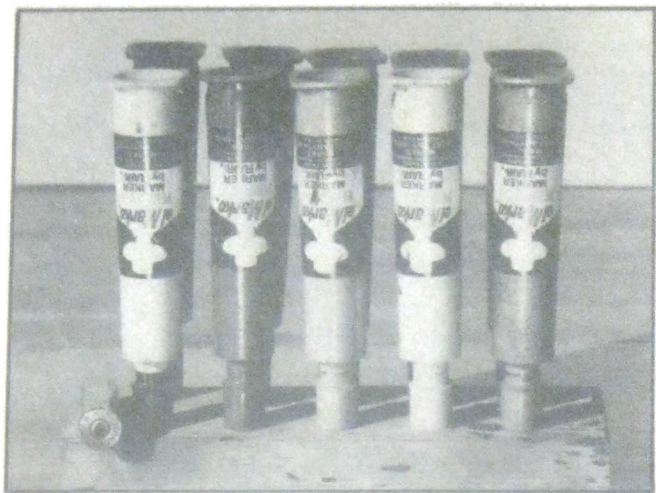
The knurled or coin-edged groove around some jacketed bullets is termed the *cannelure*. When seating such bullets, in most instances, the correct seating depth is such that the case neck comes about to the top of the cannelure. Many designs of cast bullets incorporate a *crimping groove* that serves pretty much the same function. Again, the case neck wants to come out about even with the top of the crimping groove.

If the bullet has neither cannelure nor crimping groove, do not try to apply a heavy roll-crimp to the finished load for the simple and fairly obvious reason the crimp needs some place to go and it hasn't got one. In such an instance, if you try to horse a crimp into place by sheer brute force, you are only going to distort the case mouth badly and will probably end up with a cartridge that won't even chamber.

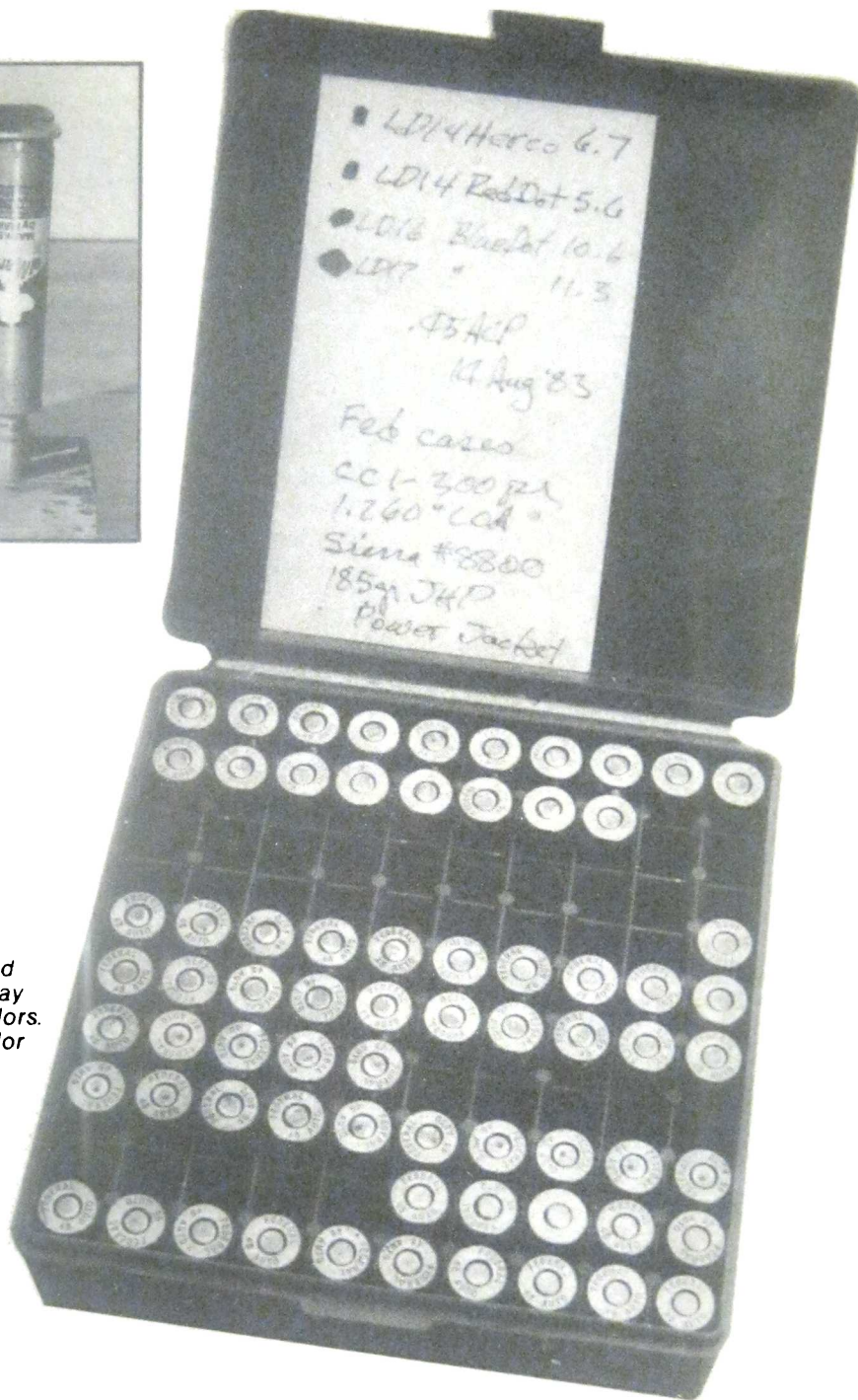
If, on the other hand, you have a bullet with either cannelure or crimping groove, having once got the bullet seated to the just-right depth, you back out the seating stem and proceed to turn the die body down by dainty and delicate degrees, stroking the press handle as you do so, until the crimping shoulder of the die body turns the mouth inward to the desired degree. At that point, leaving the ram at the top of the stroke, you turn the seating stem down to make firm contact with the bullet tip, lock it in that setting with its own little locking ring and you should have things set so that all you need to do is put the charged case in the shell holder, with the bullet resting in the mouth, guide it up into the seating die with your free hand as you stroke the press handle with the other hand and it should come out all nicely loaded and ready for duty.

To forestall frustrating disappointments at some later moment, it is an awfully good idea at this point to try one or more of the reloads to make sure they chamber easily in revolvers or feed flawlessly out of the magazine of auto pistols and so on. That is a procedure heavily laden with hazards for reasons that ought to be clearly obvious. You are trying live rounds of ammo into a firearm in the seclusion of your reloading facility where, in most instances, you certainly do not desire a loud noise and a hole in something. Observe every possible safety precaution, pointing the muzzle at the ceiling — unless there are people residing overhead — and keeping your finger off the trigger.

If the hazards seem unacceptable, make up an inert or dummy round and try that for size in the selected firearm. My point is you don't want to make up say, 750 rounds, only to get them to the firing site and discover they won't



Homemade wooden rack holds ten felt-tipped markers by the caps, making a convenient way to maintain control of them in a variety of colors. Note the round at lower left with a dab of color on the primer to identify the load. When you resize/deprime the spent case after firing, the marking on the primer is discarded. At right, an MTM cartridge box holds a number of different loads in .45 ACP, with powder charges color-coded.



chamber or feed from the magazine. Meanwhile, you don't want to blow holes through anything friendly, useful or irreplaceable, correct?

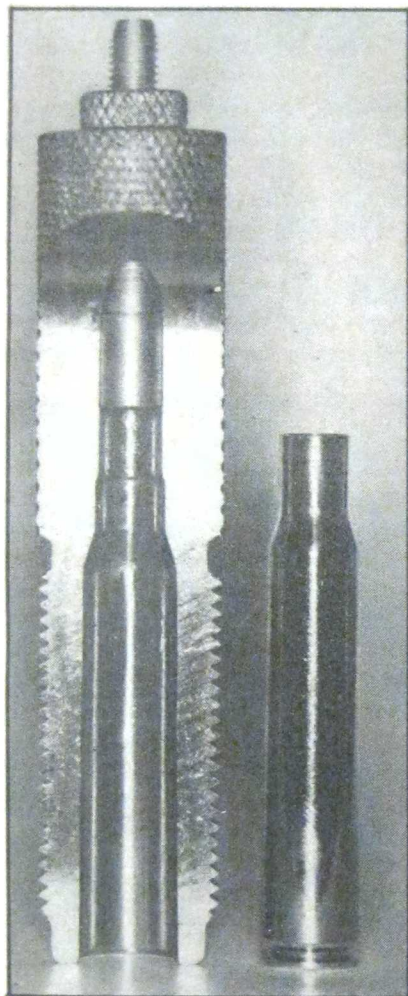
The alternative procedure, carrying things out as a two-step affair, is to seat the bullet to the desired depth, doing so with each charged case, then go through the entire lot again with a taper-crimp die suitably adjusted in the head of the press to turn in the neck of the case sufficiently to assure easy and reliable chambering, whether in a revolver, auto pistol or firearm of some other type.

Again, try to avoid over-crimping. Even a taper-crimp if applied with injudicious savagery, can degrade cartridge performance seriously, particularly in the example of jack-

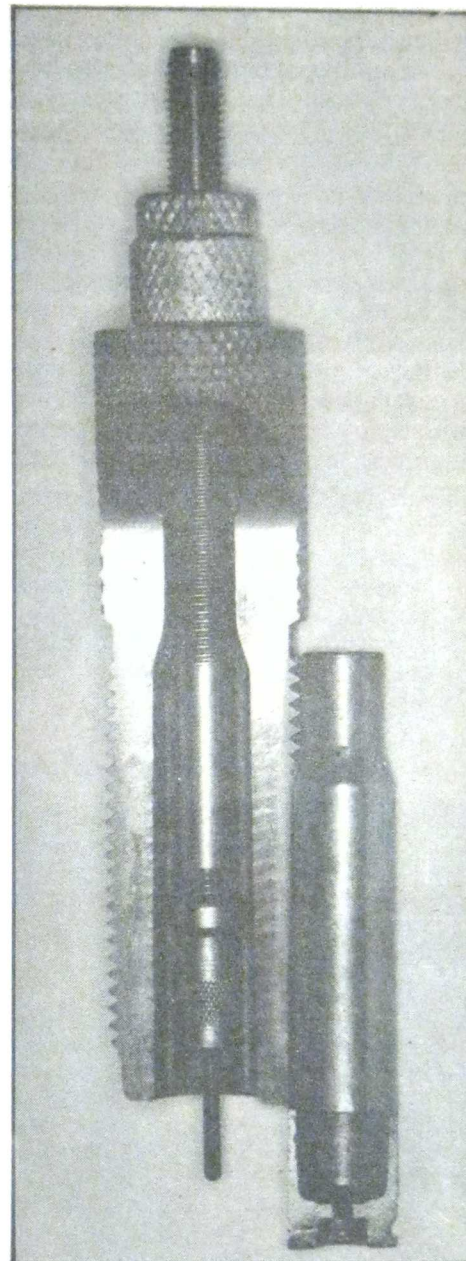
eted bullets. Excessive taper-crimping will reduce the diameter of the lead bullet core and lead, being quite inelastic, will not spring back, once having been compressed. The jacket metal will spring back a little and the case mouth will do the same. You end up with a loose bullet core and a bullet no longer gripped to the desired degree of tenacity by the case mouth. In brief, you've a lousy load and who needs those?

If you have applied case-resizing lubricant, you need to remove that before going on to fire the reloads. If left on the case, the case no longer grips the walls of the chamber with frictional resistance to rearward movement and it puts a lot of unwanted stress upon the mechanism of the firearm.

The other half of the cutaway .30/06 set from RCBS with the seating punch in place. Note the neck area of the die is shorter than corresponding part of case.



A cutaway resizing die in .30/06 Springfield, courtesy of Omark/RCBS. You can see how the case neck is sized down, then expanded as the case is withdrawn. Cutaway case has details of flash hole and primer pocket of Boxer priming.



You can wipe down the loaded round with a bit of paper towel or, better yet, you can slap the case onto a K-Spinner or similar device after getting it to load-ready status and whisk off the unwanted grease with speedy and elegant ease. The K-Spinner will be discussed in the next chapter.

About all that remains is to pack the reloads into a suitable container and add the pertinent details of the given load in a manner so as to make the data available at some future time when you set about to make up empty cases out of them once more.

Good friends and faithful readers, it pains me to confess that I have certain flaws and glitches of character that bug me passing sore (Modesty, on the other hand, is but one of my many virtues!). One of the most odious and downright *heinous* bad habits I have is failing to stipulate and specify the details on reloaded cartridges. If you can take effective

steps to avoid such shortcomings, it will enrich your life, enhance your enjoyment of the shooting sports, burnish your outlook to a rich luster and help to keep your coat sleek and glossy.

The problem, I think, is that the details of the bullet, charge and suchlike are always fresh in mind when I get done making them up and I always underestimate how quickly such mental notes tend to become stale and un-retrievable.

As a result, I am endlessly finding myself possessed of some manner of cartridges whose general basic caliber can (usually) be determined by looking at the headstamp. The bullet may be identifiable by the exposed parts of it, or may not be. As to the make/type of primer and the quantity of whatever powder, little if anything can be ascertained and the prospect of firing the mysterious artifacts sets tiny, icy salamander feet to racing up and down my spine.

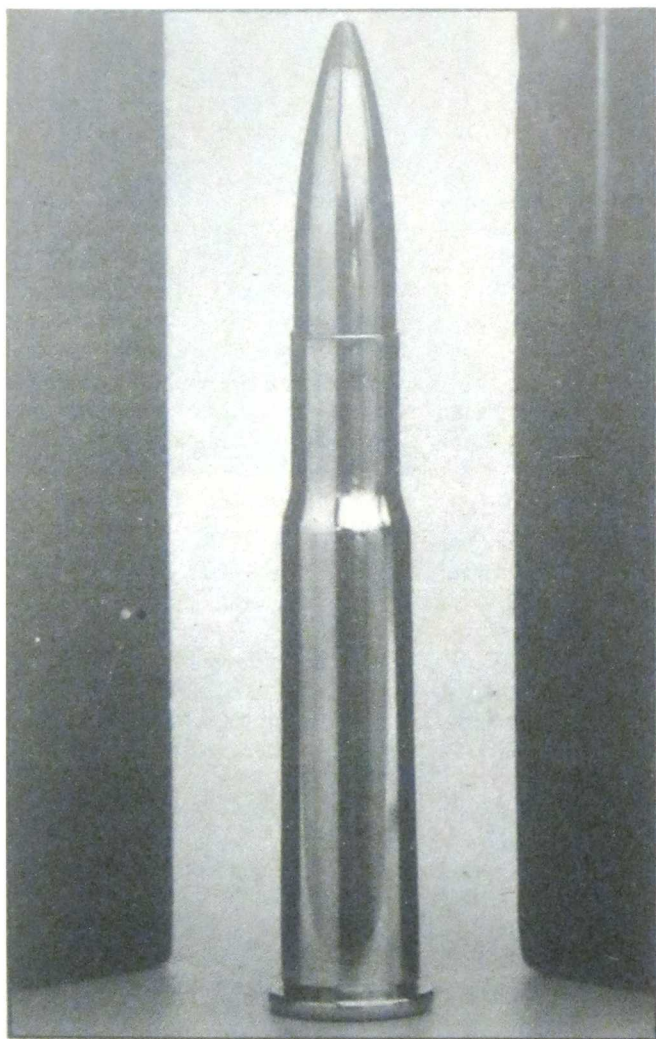
I have commented upon this sad state of things in both of the earlier editions of the present work and have spoken harshly to myself since long before that. Even so, I continue to come upon quantities of cartridges that can only be labeled G.O.K. That, of course, stands for Gosh Only Knows? I'm beginning to fear I'm a hopeless case.

For those of you still in your formative state, so far as the reloading game is concerned, I sincerely urge that you try to develop methodical habits to forestall such frustrations. Reloads, without accompanying data, represent a senseless and shocking waste of components, not to mention bench time. Just the basic details, jotted on the back of an obsolete calling card or bit of paper and dropped into a Zip-Loc baggie with the batch of cartridges will serve the needed purpose. Or rip off a bit of drafting tape, stick it on the Case-Gard ammo box or similar container and letter the details onto it. You can always peel off the drafting tape when the rounds have been expended.

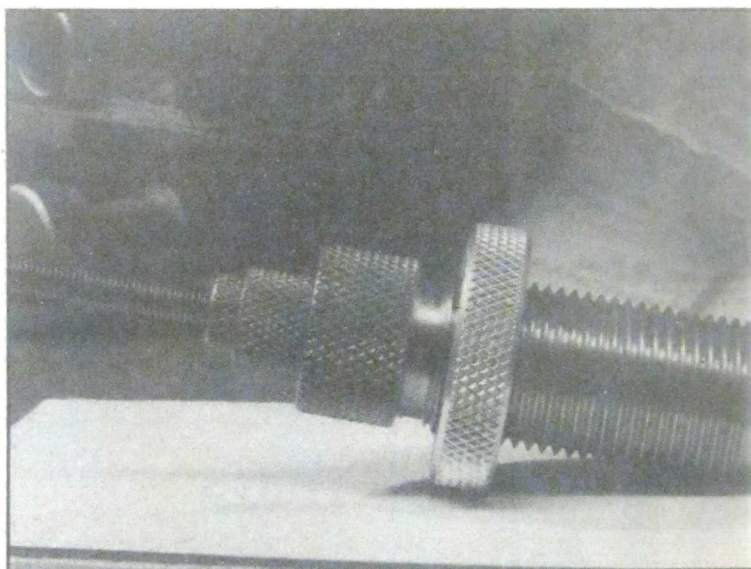
The foregoing stands as a primal introduction into the *modus operandi* for making live ones out of dead ones in the category of the ubiquitous .38 Special, the .45 ACP, and quite a lot of other calibers. It is, if you please, the ABC's with subsequent letterage kept to a minimum. That brings us to the next discussion.

BOTTLENECK CARTRIDGES

While the term should be reasonably self-defining, I'll



Above: A disassembled Hornady seating die in .357 mag, with seating punch for round-nose bullets.
(Below) An RCBS resizing/decapping die.



try to add a photo at this point to illustrate the distinction. The bottleneck concept is a useful one, since it reduces the overall length of the cartridge considerably over what it would have to have been, had the case been straight-sided. It's a pity we can't show what a .30/06 would look like if its head diameter were that of the .30 GI carbine round. You'll have to depend upon your imagination for that one.

The complexities of reloading bottlenecks are compara-

Cartridge at left is a .30-30 WCF, a bottle-necked cartridge, for which a few bolt and single-shot actions have been chambered. The pointed bullet can be used in such guns, but should never be used in a gun with a tubular magazine because of the danger of setting off a chain explosion from the force of recoil!

ble to those of doing up the straight-sided jobs, but a bit more so. For one thing, there are no tungsten carbide reloading dies for the bottlenecks at any price the average reloader may feel inclined to disburse. You have to apply sizing lube and, after sizing, you have to get it back off. If you forget or neglect to apply the sizing lube, there is a high degree of probability that the dry case will remain stubbornly locked up in the sizing die as you apply muscle to the press handle and, in time, wrench the rim right off the case, leaving it *in situ*.

If that dire thing should happen, you will want a stuck case removing kit and some of the more helpful makers of reloading dies market such kits for use by those who simply refuse to listen. We'll try to take up the intimate details of the stuck case kits elsewhere here. You need to know about those, but if you're crafty, you'll never actually need the use of one.

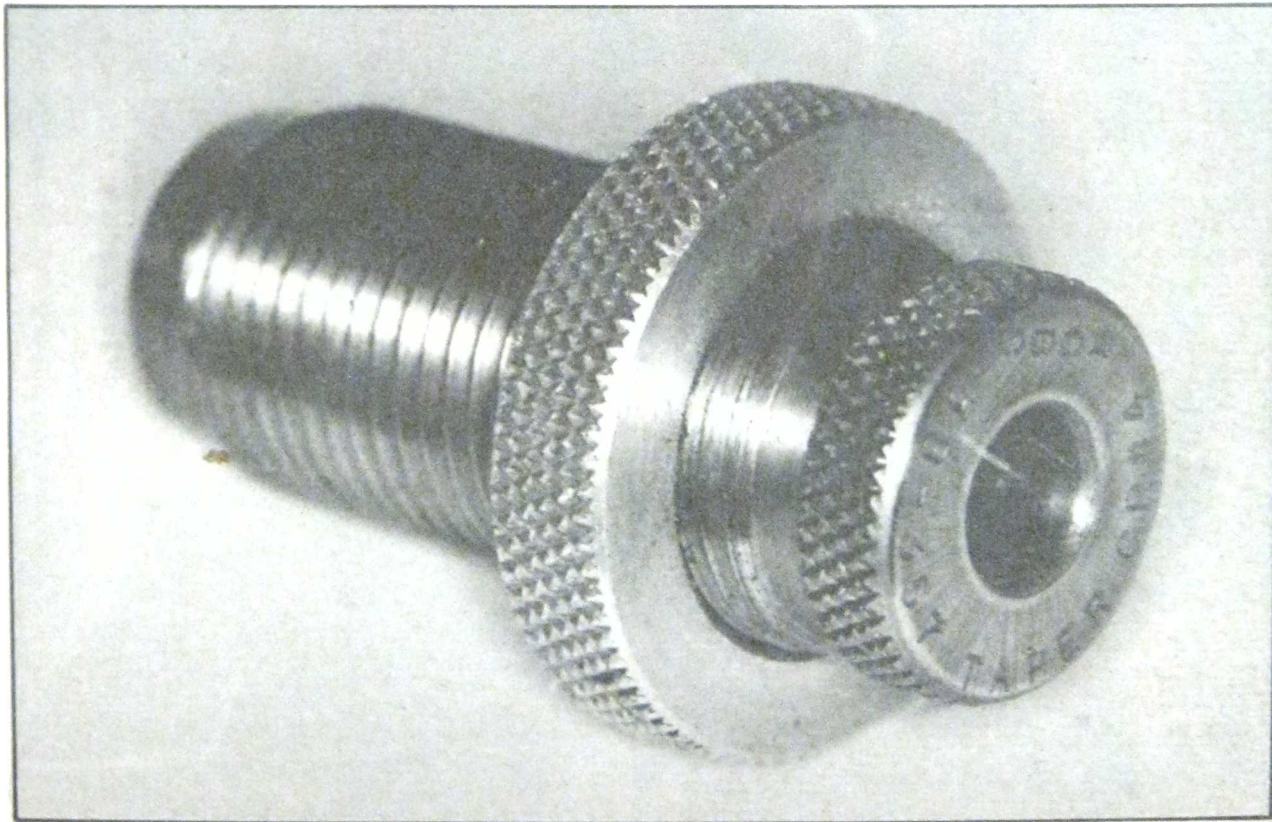
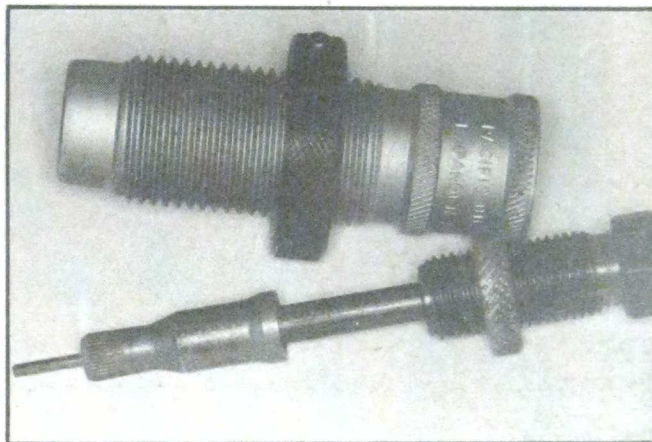
The customary design of the sizing die for bottleneck cartridges positions an expanding plug on the stem that holds the decapping pin. With the die adjusted so that the top of the shell holder makes firm contact with the lower end of the die, the case is restored to its proper dimensions,

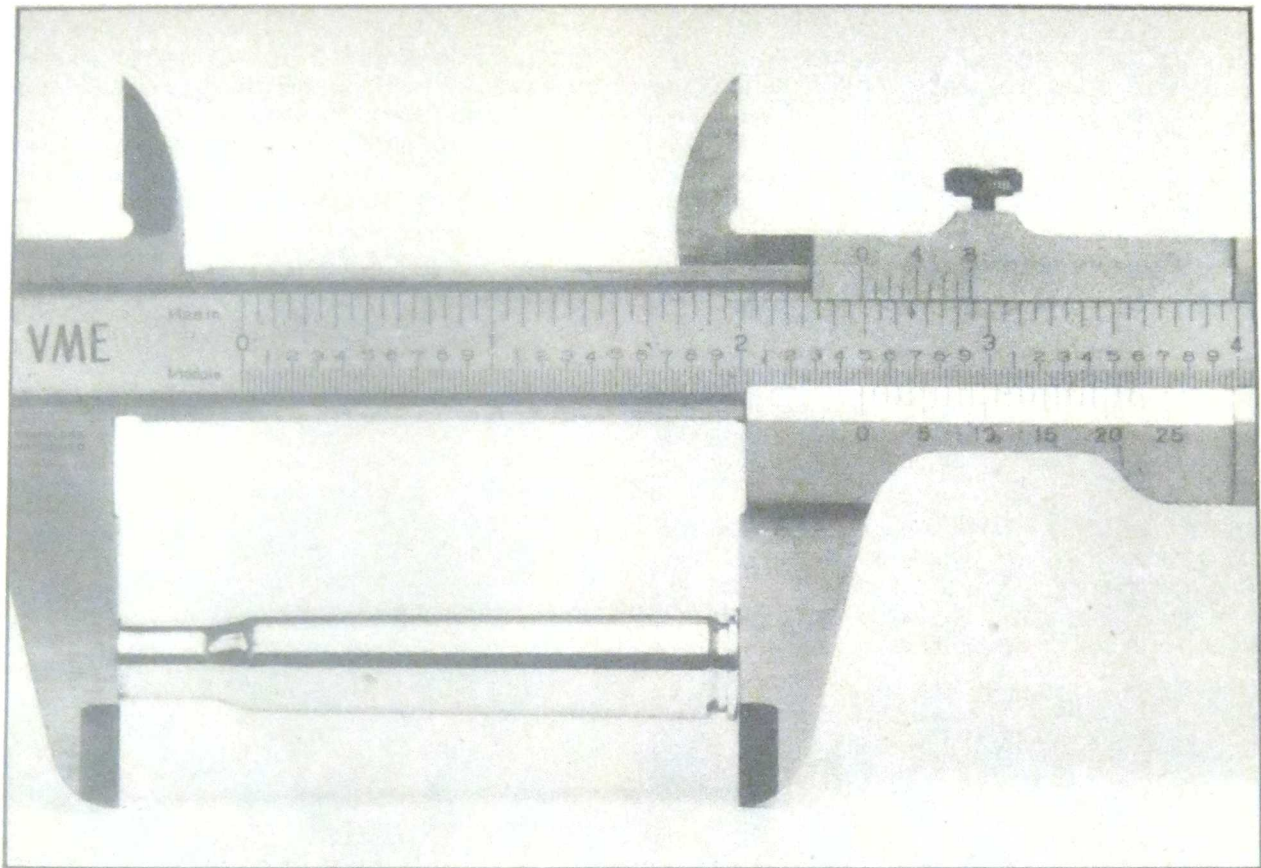
A Hornady/Pacific expand/decap die, disassembled to show the expanding plug and taper to flare the case neck. A third die performs the initial resizing in the customary Hornady set, as discussed in text.

This is a taper-crimp die from RCBS for the .38 or .357. Used properly, it will iron the neck flare neatly back into a straight line for easy chambering. Given a tight grip of case neck to bullet base, that's all the crimp you really need, in my opinion.

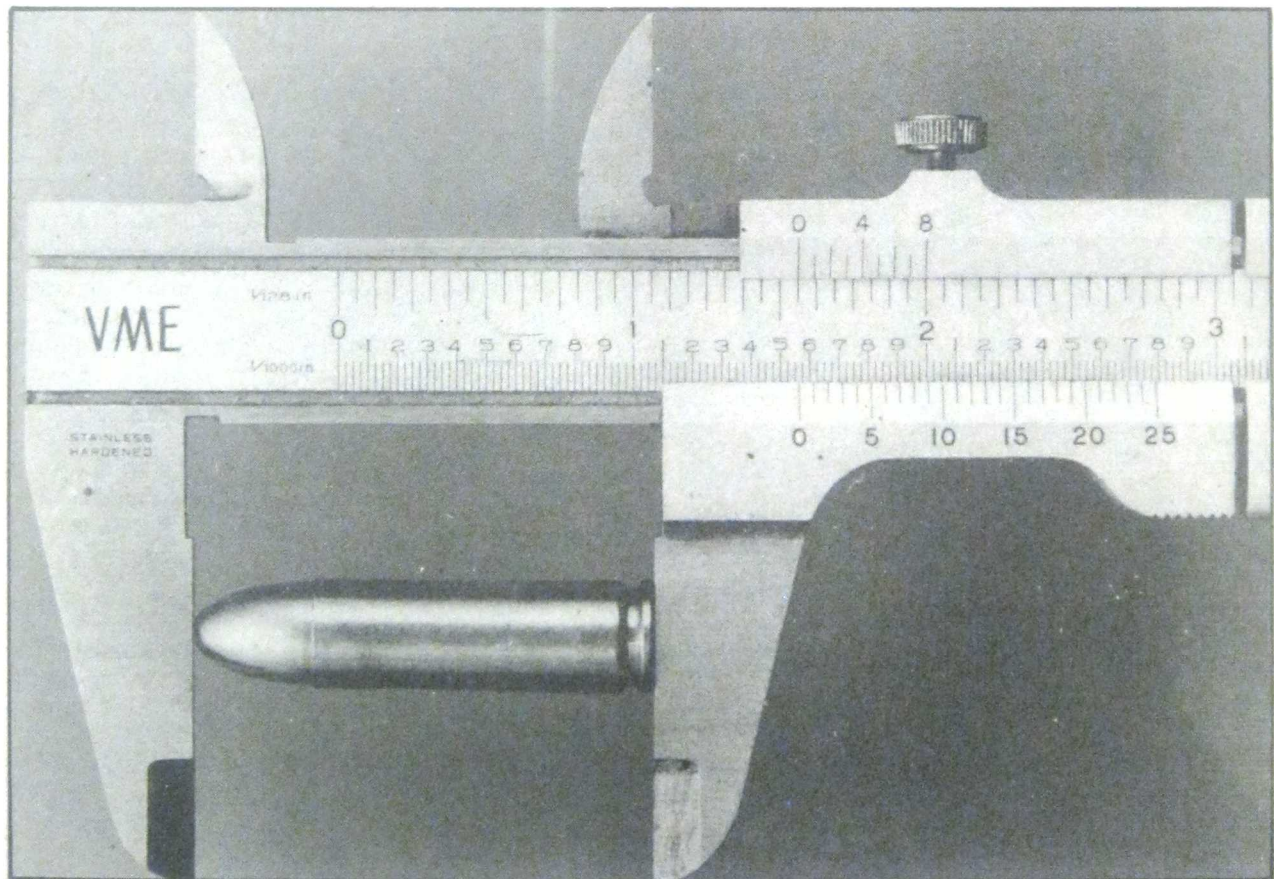
except that the case neck ID is slightly on the small side. When it is pulled down out of the die by reversing the press handle, the expanding plug is pulled out through the neck, thereby expanding it to the proper ID.

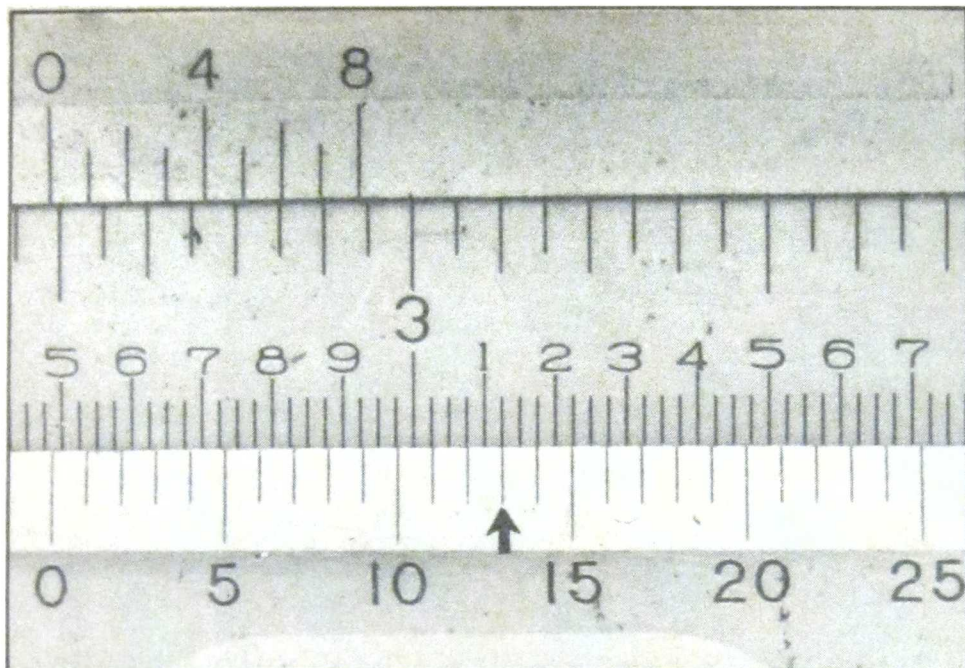
Two things operate to elongate the bottleneck case. If its fit in the chamber before firing — termed *headspace* — is not close and tight, pressure of the powder gas will force the case head against the bolt face and the shoulder against the chamber shoulder, thereby stretching it slightly. A less-than-solid lockup of the action will have much the same effect. The old Short Model Lee Enfield, firing the .303





The latter-day trend is toward dial calipers, but the older vernier calipers can also be used to check case length, as in the 30/06 above, or length overall (LOA) as in the 9mm Win. mag below. Details of the measurement of the case length are explained in greater detail on the opposite page.





Nominal .30/06 case length is 2.494 inches. It's easy to see we have 2.475 and a little bit more. Line 13 on the lower scale is the one that aligns precisely with the line above it, indicating that we add .013 to the 2.475 for a total of 2.488 inches. Upper pair of scales read the dimension to the nearest 1/128-inch, while lower pair of scales give it to the nearest 1/1000. Upper scale of the lower two is the actual dimension while lower scale "splits" each of the dimension graduations into 25 equal parts, since each graduation equals .025-inch.

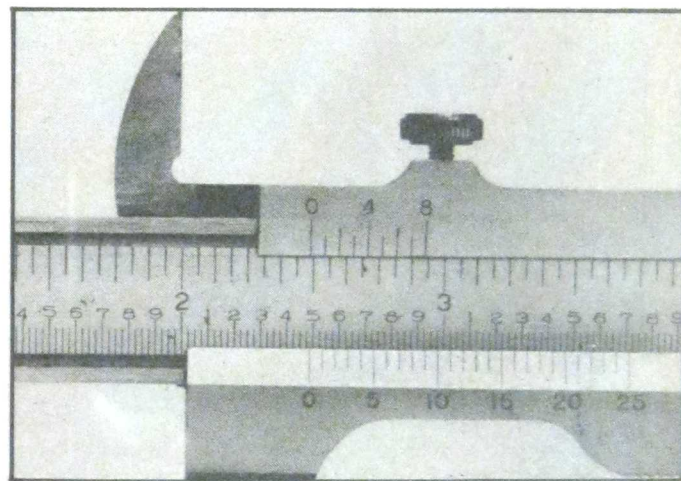
British cartridge, tends to be a notorious case-stretcher for the reason just given and often proves to be a problem for reloading because the stretching causes case separation after a few reloadings. The other stretching effect is that of pulling the expanding plug back out of the neck of the freshly resized case.

The expanding plug, being larger than the neck ID, sets up considerable friction in passing through the neck, as indicated by a nerve-chilling "skraunch" when it does so. The sound effect, as well as the frictional resistance, can be reduced considerably by application of a *small amount* of resizing lube to the inside of the case neck, by means of a small bristle brush. Some prefer to use graphite or molybdenum disulfide in place of a grease-type lube, feeling the grease may partially deactivate the powder charge.

At any rate, bottleneck cases are quite apt to come out of the resizing operation slightly longer than the specified length. A case that is excessively long if reloaded and fired, will develop higher peak pressures than an identical load with a case of the correct length. It does little good to check and trim the cases before resizing because, as just mentioned, some of the stretching takes place at the time of resizing.

As the bottleneck cases come from the resizing die, before the primer is seated, they are in an ideal condition to be trimmed. Many different manufacturers offer case trimmers. These operate by installing a pilot plug in the end of the cutter. The pilot ~~is~~ a close fit inside the case neck and gives it guiding support during trimming to prevent chatter marks.

One of the handiest, quickest and least expensive devices for trimming the case is a small trimmer kit made by Lee Precision. These are sold in the form of two bubble-packs. One kit contains the cutter and base plug and you only need one of those kits. The other kit contains the shell holder ring and the guide rod that has a pin similar to a decapper on the end of it. The second kit is sold for the specific cartridge. In use, you screw the guide rod into the



cutter, start the shell holder onto the base plug, insert the head or rim of the case into the shell holder, tighten it down against the base plug and insert the guide rod into the case mouth, making sure the pin goes down through the flash hole and into the primer pocket. As noted, there will not be a primer in the pocket at this time.

The guide rod establishes correct case length for the given cartridge. As the cutter is rotated, it removes any excess brass at the case neck until such time as the tip of the pin touches the top of the base plug, arresting any further trimming.

The Lee Precision trimmer can be used by hand but it's quicker and easier to install the top end of the cutter in a drill press or similar tool with a one-half-inch chuck and perform the trimming under power. Take care to keep unwary fingertips away from the whirring cutter blades because they are sharp and formidable!

The case, after being trimmed, will have a pronounced burr on both the outside and inside of the mouth and both burrs need to be removed before proceeding with the reloading operation.

My favorite way to remove the outside neck burr is to take them back to the press, with the resizing die still installed, and give them just a light pass back up into the die, so the neck just gets inside the neck portion of the sizing die. When you pull it back out, the outside burr will be gone. You may wish to reset the sizing die higher in the press to keep this operation uniform, rather than doing it by judicious feel.

There are also inside/outside case neck deburring tools offered by several makers and all will do a good job, though it's a tedious operation when done by hand to a large number of cases.

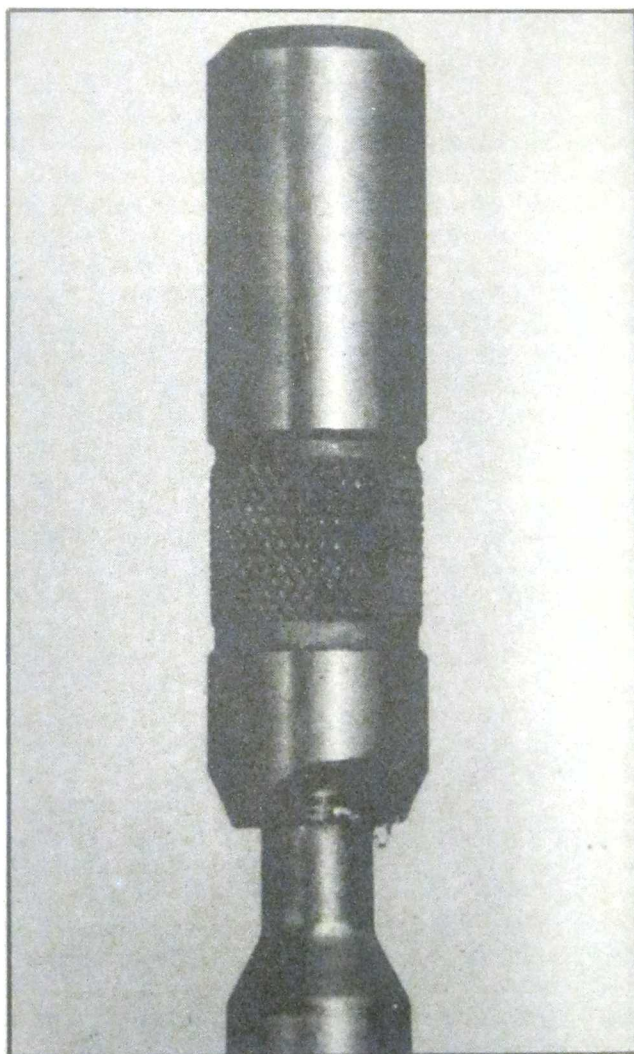
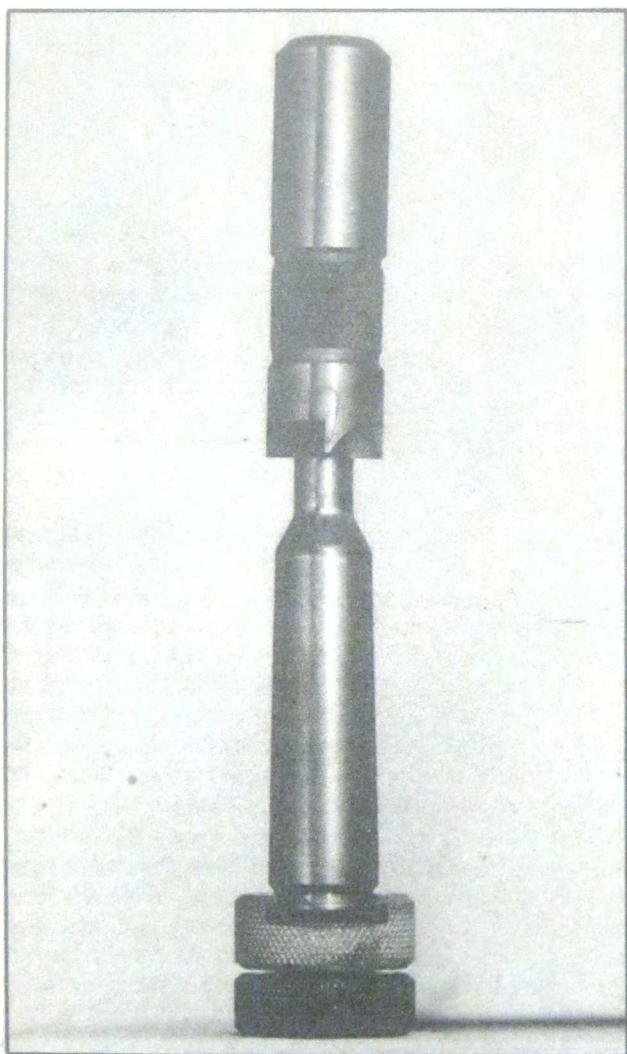
The inside case neck deburring method I greatly favor is to get out the Forster Brothers case trimmer and install the appropriate size of neck reamer in the end of the cutter. There are three collet inserts for the Forster trimmer, one of which will tightly clench just about any cartridge head. Install the proper one, secure a case in it and take just a few gentle turns of the reamer into the case neck. The front of the reamer is tapered, as can be seen in the accompanying photos. Trim until you can just barely see a thin bright ring of cut brass in the case mouth. Lock the stop-collar at that

setting and give all the rest of the cases the same treatment. This results in an elegantly chamfered throat that makes seating of the bullets just a mellow delight.

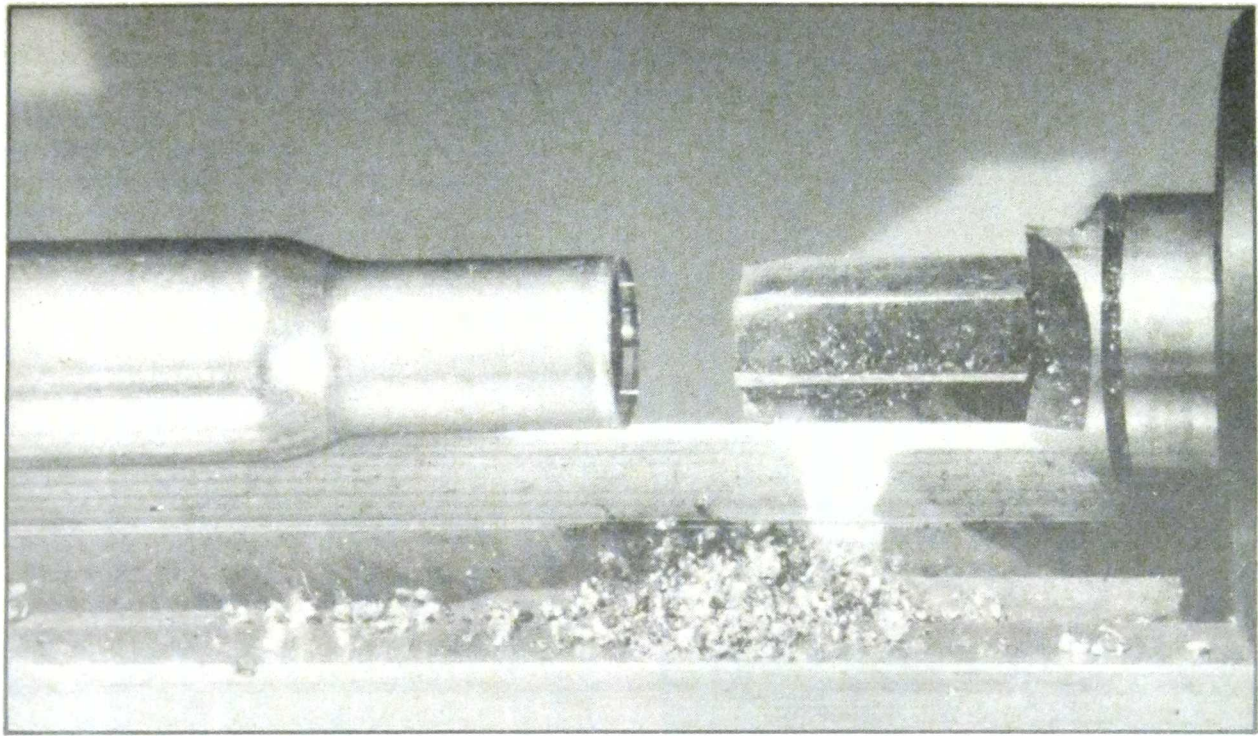
The reamers, I should note, are designed to remove excess brass from inside the case neck *before* the case is resized. Some cartridges tend to thicken at the case neck and such a condition can be detected by trying to insert the base of the given bullet into the neck before resizing. If the bullet won't go, a full pass with the reamer will get everything back to specifications again. If you ream a case that has already been resized, you will remove so much brass the case will be ruined for further use.

Quite a number of military rifle cases, and a few of the military pistol cases, have their primers stamp-crimped into place after seating. After the primers have been punched out, such stamp-crimps must be removed before a new primer can be seated. The stamp-crimping is done to prevent the primer from backing out of its pocket and causing malfunctions in full-auto weapons.

Cartridges in which stamp-crimped primers may be encountered include — but are not necessarily limited to — .223 Remington, .308 Winchester, .30/06, 9mm Luger



Two views of the handy case trimmer from Lee Precision, operating upon a .22-250 Rem case. The upper trimmer portion can be put in a drill press with a 1/2-inch chuck to speed the operation.



Inside neck reamer for the Forster trimmer can be used to neatly throat the case neck after resizing. This eases seating of the bullet. In normal use, reamer is used before resizing to remove excessive thickness of the case neck but, in this application, the stop collar is adjusted to halt it at this point.

and .45 ACP. At one time, .45 ACP military loads from Frankfort Arsenal — FA headstamp — were loaded with a special primer of about .206-inch diameter instead of the .210-inch diameter customarily used. If you encounter any of those, and it's rather unlikely any more, cull them out and set them aside or discard them because there's no practical way to adapt them to conventional primers.

The stamp-crimp can be removed by cutting or by swaging, physically removing the unwanted metal or merely wedging it out of the way. The Forster inside case neck deburring tool, installed in the neat little rotary unit from the same maker, does a fairly satisfactory job of cutting the stamp-crimp away, although the treated pocket still offers minor resistance to seating the new primer. Primer pocket swaging punches are offered by various other makers, or you may be able to construct your own version, as will be discussed in the next chapter. The good news is that removal of the stamp-crimp only needs to be done once to any given case.

It is, of course, quite unnecessary to worry over the matter when reloading commercial cases and we should all feel grateful for that!

A word about case resizing lubricants: Just any old oil doesn't work well. You need a lube specifically engineered, made and sold for the purpose. Improper lube can leave a case locked in the die, with the rim wrenched off, just as if it had carried no lube at all. More, you apply just barely enough, not too much. Too much lube is quite apt to cause unsightly dents in the shoulder area of the resized case.

After you've finished resizing the case, and either before or after you check its length, trim and remove the neck burrs. It is necessary to remove the lube from the case

before proceeding with the rest of the steps. A K-Spinner in an electric drill or drill press, as described in the next chapter, works extremely well, using a piece of rag or paper towel to wipe off the lube. You can also wipe it off by hand, perhaps using small amounts of a suitable solvent. That takes more time and effort, but it also works. The important thing is to get the lube off before the cartridge goes into the chamber and is fired. Lubricant between the case and chamber walls lets the case slip rearward to impose a lot more stress against the bolt face, standing breech or similar component of the action.

As you look into the primer pocket of a fired case after it's been resized and deprimed, you will probably see some amount of crud and residue left from the previous firing. Many reloaders prefer to remove this, leaving the pocket clean and bright, before going on to seat the next primer. The exact necessity of doing so is a moot and debatable point. It can be said with firm certainty that the cleaning operation should not be so vigorous as to enlarge the diameter of the primer pocket. Beyond that, cleaning the pocket hurts nothing and may even be helpful.

If you're removing the sizing lube on a K-Spinner, it is easy and simple to put a small tuft of fine steel wool on the tip of a short piece of wooden dowel of suitable diameter and push it up into the primer pocket of the spinning case to whisk away all of the unsightly residue. A further pass with a larger piece of fine steel wool — grade 0000 or 00000 — against the case itself will burnish it to a brighter shine and, if you really feel inclined, you can put a dab of Happich's Simichrome metal polish on a piece of paper towel, followed by a wipedown with a clean piece of paper towel to impart a mint-bright finish to the case.

The purely cosmetic steps can be omitted, as you choose, without causing any harm at all. We still need to seat the primer, add the powder charge and seat the bullet. As before, we will have consulted one or more of the manuals/handbooks offering load data and selected a suitable charge of an appropriate powder for the weight of bullet we propose to load.

There is a chapter coming up that may tell you more of the fine intricacies of bullet seating than you really cared to know and you are referred to that for the fine flecks of nitty and gritty. For the present, let's note the overall length of the reloaded round needs to be short enough to enter the magazine, if any. In the examples of slide-action or auto-loading rifles, it also needs to be short enough to permit ejecting a live round from the action, if desired.

When it comes to installing the seating die in the press, an approach that usually works well is to put a factory load in the shell holder, run the ram to the top of its stroke, back

the seating stem well up out of the seating die, turn the seating die down until it makes light contact with the cartridge, lock it in that setting with the locking collar and then turn the seating stem down until it is felt to touch the tip of the seated bullet, locking the stem in that setting with its locking collar. That gives you a pretty close starting adjustment that may have to be modified slightly when you get to seating the bullets.

Putting the listed charge from the manual/handbook into the given case may pose a challenge. Sometimes, they specify more powder than you can readily coax into place. It helps, in such cases, to hold a powder funnel in place and dribble the powder slowly into the funnel in such a way that it swirls on the way down. Holding the funnel in place, tap the base of the case gently but firmly on a solid surface.

In some rifle loads, the base of the bullet will encounter the top of the powder charge before the bullet is fully seated to the necessary depth. Usually, this is no cause for grave alarm. Most rifle powders can be compressed moderately without bad effects.

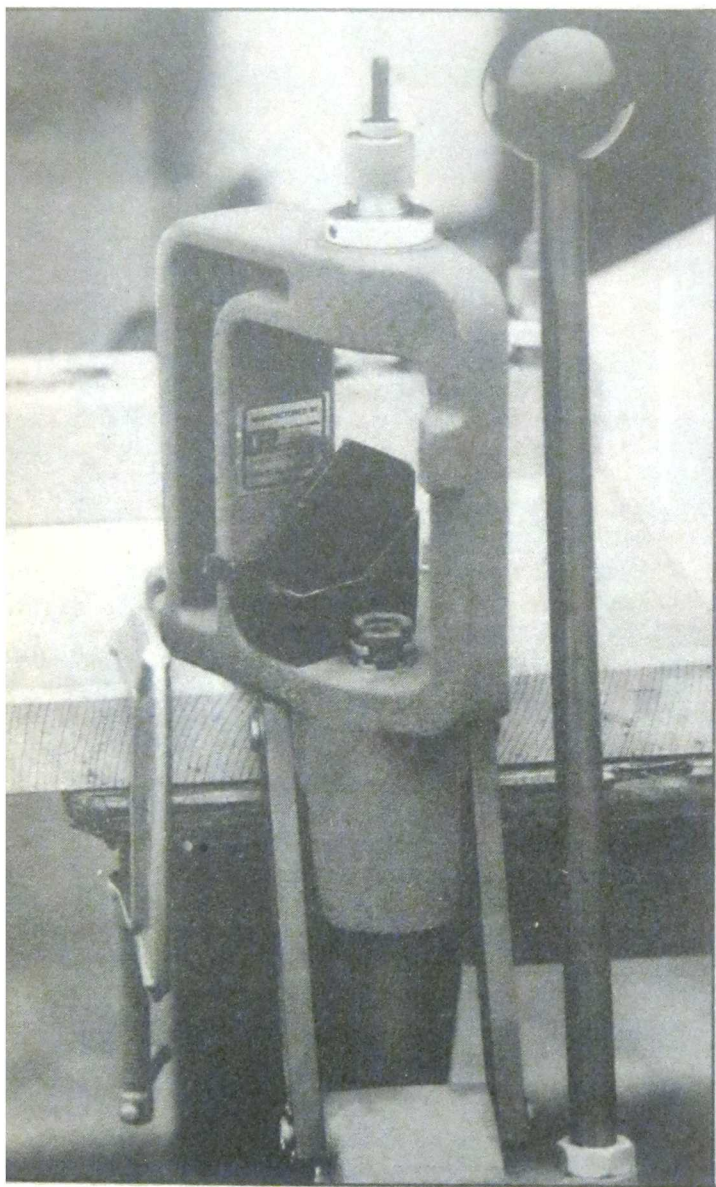
Indeed, a large amount of unoccupied air space within a rifle cartridge usually is a liability, rather than an asset. Low-velocity loads, made up with a light charge of fast-burning powder, show lots of air space in typical examples but that's about the only exception. Let me add in all haste that such "squib" loads should be made up only to the data set forth in a manual or handbook, adhering carefully to the specifications given there.

The seating depth of any loaded bullet can be gauged visually by holding another of the same bullets next to it, aligning the tips to show where the base of the bullet ended up. It is pleasing to one's sense of fitness if the base of the bullet is nicely lined up with the base of the neck but, in many instances, it is necessary to seat the bullet with its base well below that point. That does not seem to pose any obvious problems.

As will be discussed in greater depth later, the curving front end of the bullet, or *ogive*, should not make hard contact with the commencement of the rifling, or *leade*. At most, the bullet can just touch the leade again, even then, it boosts peak pressures over what you'd get if it had just a little amount of free jump in which to build up momentum for the difficult job of engraving itself into the rifling.

Using suitable precautions to prevent damage or injury if the cartridge should fire, you can chamber one of the loads and then remove and examine the bullet to see if it carries any visible marks from the rifling. If it does, it should be seated deeper until it doesn't.

As with the handgun reloads, the rifle variety should be put up in suitable containers and labeled with the information necessary to duplicate the load: make of case, make and type of primer, powder and charge weight; make/weight/type of bullet and overall length of the loaded



On this and facing page, we see a Hornady/Pacific press mounted to a small piece of plank held to the bench with C-clamps; a handy arrangement.

Small block glued to the rear of the mounting plank holds a spare shell holder plus three reloading dies. The small plastic box for a set of Lyman mould blocks is held to the plank with four sheet metal screws as a means for keeping track of the detachable priming arm and the other size of priming punch not in current use.

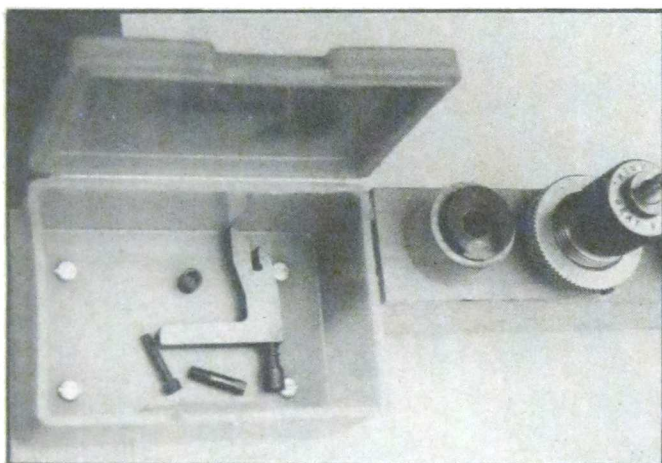
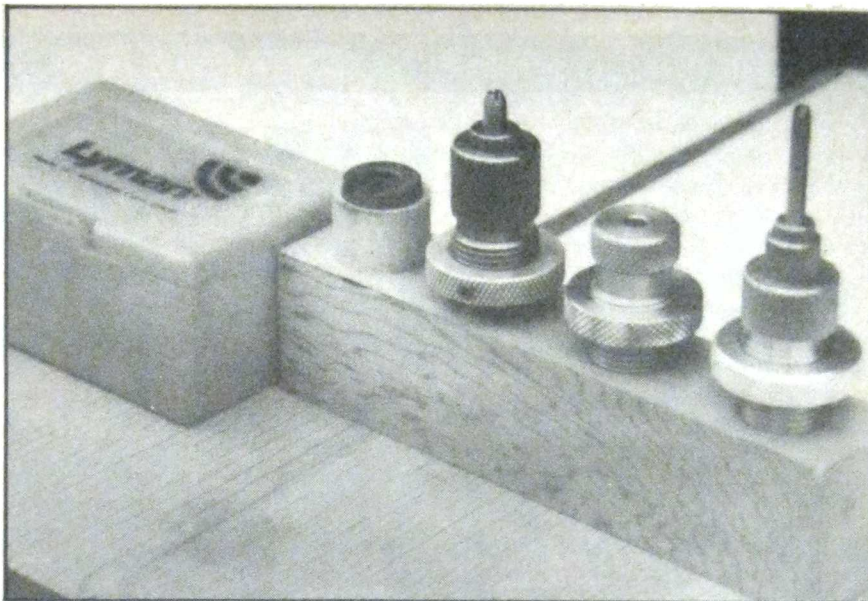
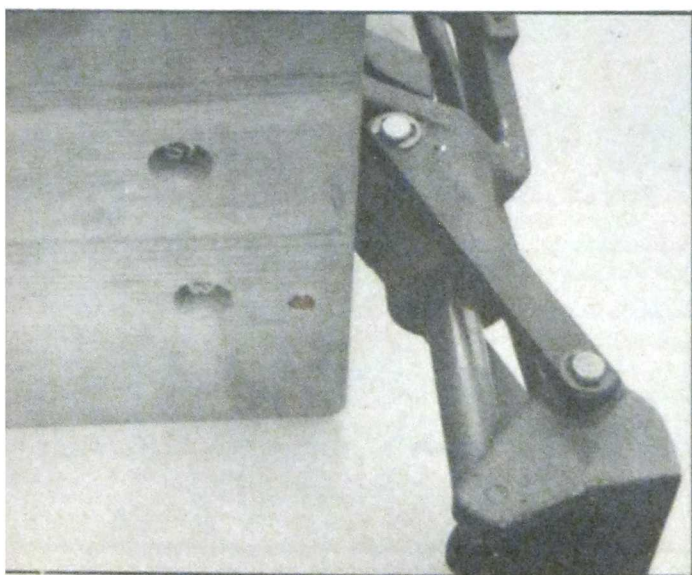


Photo below illustrates how the two mounting bolts have their heads counterbored into the lower surface of the plank to simplify attaching to a working surface.



round. It's a good idea to include the date, as well. If you are of a methodical turn of mind, you may wish to maintain a journal of your reloading activities, with space allotted in which an evaluation may be made of performance of the given load. Several sources offer the forms and paperwork for doing that, or you can make up a form to your personal taste and run off the desired number of copies at your neighborhood copy shop. Save the top copy so you can make up more if it works out to your liking.

Reloading equipment comes in a great many forms, sizes and designs. That makes it difficult to offer hard and fast instructions for setting up the basic bench, but a few generalities can be offered.

With but few exceptions, reloading presses work best if securely anchored to sturdy surfaces that don't move under the stresses involved. I have long considered $\frac{3}{4}$ -inch plywood to be inadequate as the top material for a reloading bench. The so-called two-inch planks, actually $1\frac{1}{2}$ inches thick, as dressed, work well as bench tops. So do sections of solid door core material if you can put hands on them. Supporting legs should also be sturdy, at least 2x4 inches in cross-section and suitably braced.

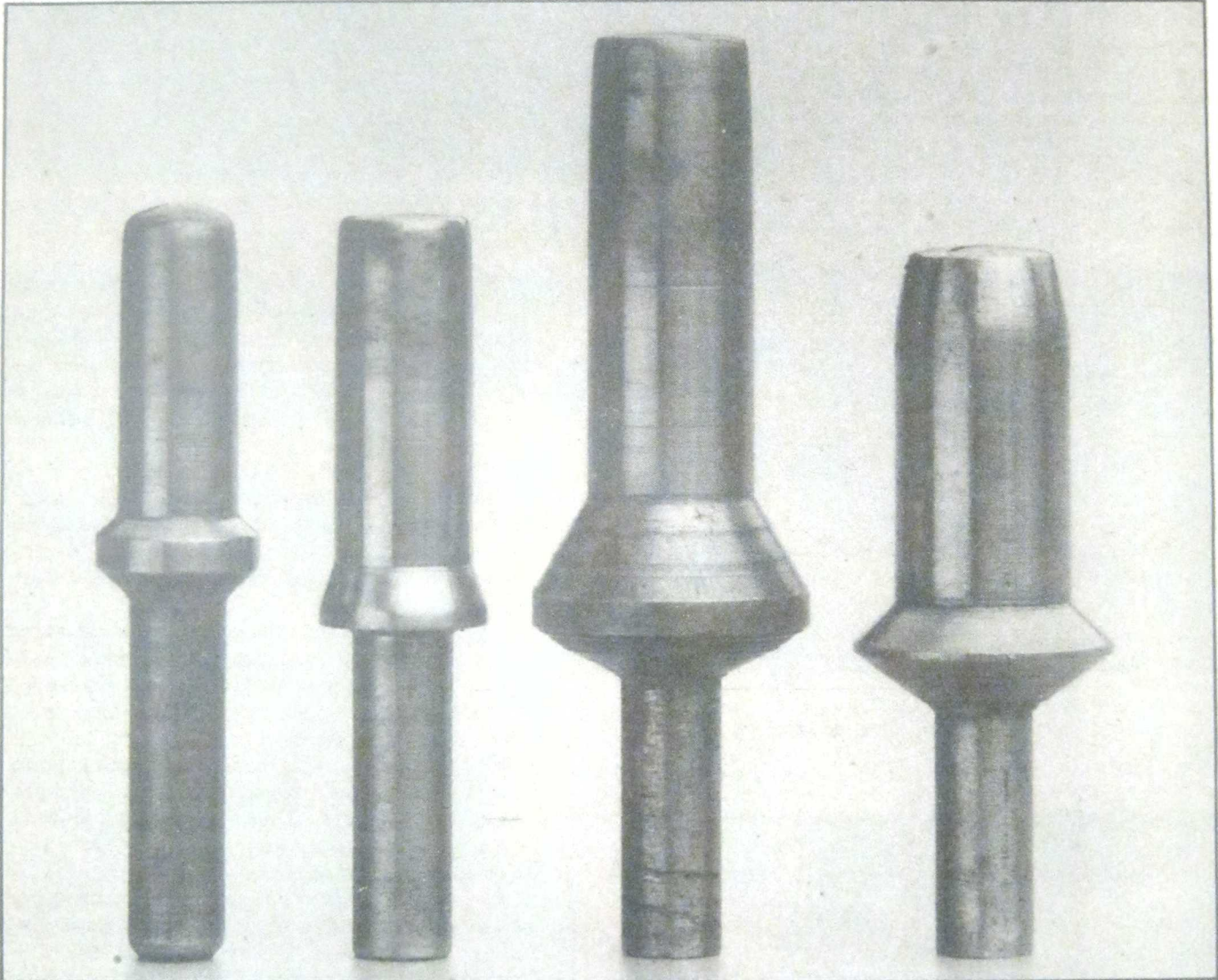
I like to reload while on my feet and can report that it's ideal if the top of the bench is about even with the upper edge of your belt or with the point of your elbow with forearm horizontal.

I like to bolt the press to a small piece of two-inch plank, perhaps 10x12 inches or so, counterboring from the bottom to keep the bolt heads from protruding. With that done, it is a simple matter to attach the press to the bench with a pair of C-clamps and move it about for maximum convenience in the session under way.

A lot of my reloading time seems to get wasted in quest for some elusive small but vital gizmo and any storage system that minimizes such vexing confusion is of great value.

At the bottom line, the way to get started is to *start*. Try your hand at it and pick up the details as you go along. Always watch for the better way to do it.

HOMEMADE RELOADING EQUIPMENT



This is the original quartet of K-Spinners, as produced on the metal lathe of a friendly dry cleaner about 1962 or so in calibers .30, .38, .44 and .45, all with 1/4-inch shanks. They've seen a lot of use.

**Taking A Number Of Looks At Ways In
Which One Can Make Up Helpful Doodads
For Producing Superior Results In Reloading**

THE K-SPINNER was mentioned in the previous chapter with the note that it would be covered here. Sending down to the corner drug-store for a small sack of radiocarbon, I can date the invention of the K-Spinner or case-spinner at about late 1962, shortly after I purchased the unpretentious but incredibly useful Atlas drill press I've long since called "Chuck." The Atlas table saw, also bought in late '62, is known as Euripedes. Those old enough to recall ads in the old pulp magazines for muscle-building courses from Chas. Atlas will recognize the source of the name and, after all, what name could be more fitting for a drill press? Atlas made much over the fact he was once an eighty-

seven-pound weakling. Big deal. I was once a 10½-pound weakling, but now I'm a 188-pound weakling.

Seriousness aside, a drill press is so infernally useful I think everyone should make efforts to obtain one. Dividing its original cost by its years of faithful service, Chuck Atlas has cost me perhaps \$2/year and has been worth many times that much.

In the early Sixties, I still resided in a thoroughly unlikely Wisconsin hamlet and I had my dry cleaning done at a firm called Rupp's Dry Cleaners. Joe Rupp, son of the proprietor, was a friend of mine and he made arrangements for me to use the metal lathe at the rear of the shop. I had had a few weeks of machine shop training at the Racine (Wisconsin) Vocational school, about the time the Japanese were gearing up to tenderize Pearl Harbor and retained enough shaky expertise to knock out four prototypical K-Spinners on the Rupp lathe. I still have all four, one apiece in .30, .38, .44 and .45 size and the quartet should be illustrated nearby if all goes according to plan.

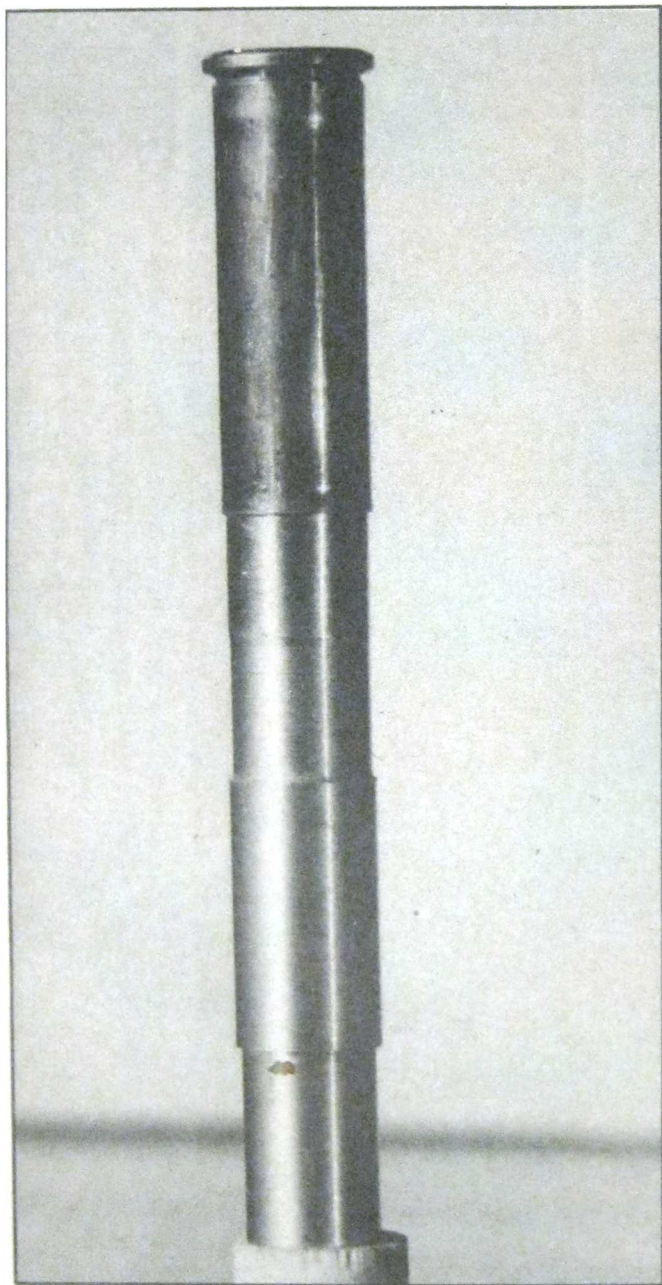
In early 1963, I moved to Milwaukee and thence to one of its more improbable suburbs. In early 1964, the .41 magnum cartridge made its debut to an audience that continues to be less than suitably appreciative. Having become the grateful owner of a Model 57 Smith & Wesson revolver in .41 mag and, some while after that, some factory ammo to fit it, I was seized with a burning yen to make up a .41 K-Spinner, but Joe Rupp's helpful lathe was no longer at my ready disposal.

That's when I found, given sufficient dogged patience, one can do wonders of machining on a mere drill press with the aid of a flat file of the sort rather vulgarly termed a mill bastard. Rummaging about the scrap box, I came up with a short piece of brass rod measuring 7/16-inch in diameter. That's .4375-inch. Keying it into the chuck, I began draw-filing its diameter down toward the near neighborhood of .410-inch. At the time, I had no micrometer and even the useful vernier calipers were not yet in hand. I homed in upon the desired diameter by pausing every little while to try the mouth of a case over the emerging artifact.

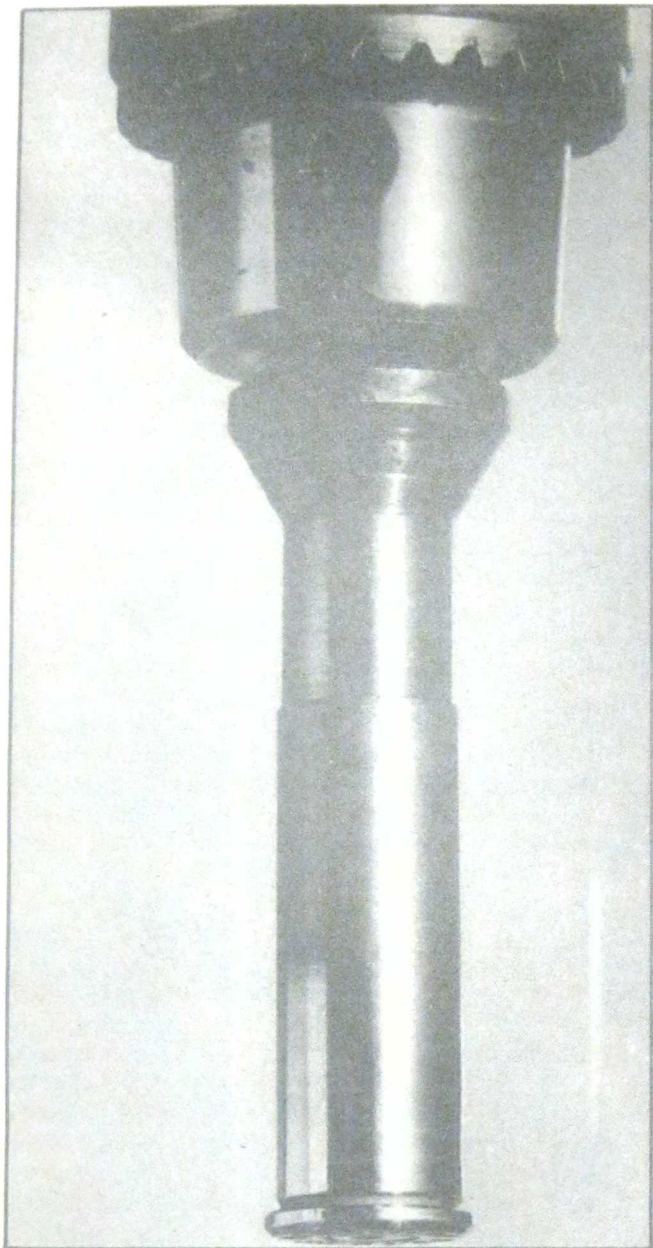
It is astonishing the work that can be turned out on primitive equipment. Tribesmen in the hills of India used to produce surprisingly decent military rifles on crude lathes powered by the artisan's foot. Given sufficient motivation, hardly anything at all is impossible.

The .41 mag K-Spinner was a pronounced success and its production took less time than I expected. Until fairly recent times, its upper shank was still cut at a slanted-off angle but I finally slapped it into the big 10x24-inch Jet metal lathe that has graced the shop since late 1980 and trued it off. I'll try to include a photo of that historic artifact, too.

About that time, I needed a K-Spinner for cases having an ID of .224-inch or so and chucked a short piece of .25-inch diameter bar stock into the drill press and whomped that forth with no trouble at all.



The caliber .41 K-Spinner was made up a couple of years later from 7/16-inch brass rod, using a flat file and a drill press. Some twenty years later, having access to a metal lathe again, I finished it.



On this .44 magnum case, I applied a bit of Happich Simichrome metal polish to the lower end to show what can be accomplished on grundgy old cases.

I can't resist noting that there is a strong if unsuspected correlation between reloading and dry cleaning. Apparently, you need reasonably sophisticated shop facilities to keep the dry cleaning machinery on the line and doing its duty. The array of machine tools at the rear of dry cleaning shops have made yeoman contribution to the world of reloading down the years.

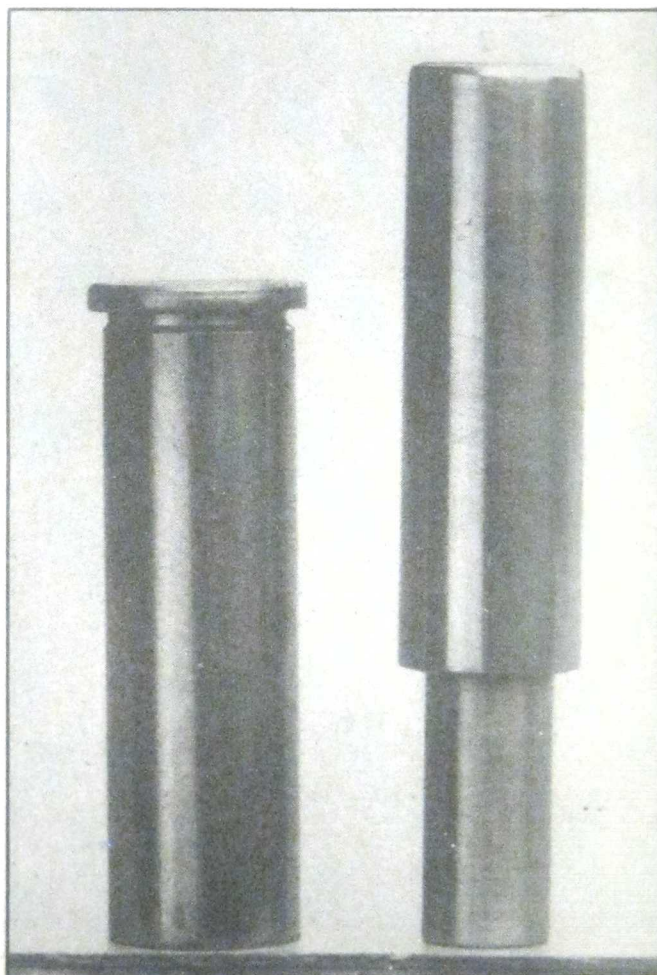
Fred Huntington used the lathe and other gear at the rear of his family's dry cleaning shop in Oroville, California, to produce the first bullet swaging dies that served as the nucleus for the RCBS output of the present day. RCBS stands for Rock Chuck Bullet Swage, if you didn't know. Huntington made those primal prototypes from steel salvaged from the axles of retired Model T Fords.

In the summer of 1942, I worked in Waukesha, Wisconsin, and had my dry cleaning done at Normington's Dry

Cleaners, situated just an easy walk from my rooming house. I did not discover until many years had come and gone that the son of that family was the Jim Normington who was later to become a key figure in the early development of the Ponsness-Warren line of reloaders. Up through the mid-Seventies, Jim and his wife, Clara, were familiar figures in any number of reloading seminars as Jim would discourse the sovereign virtues of the P-W presses in stentorian tones developed upon countless drill fields.

Olive-witch may seem to be neither Damon nor hardly yet Pythias on the matter of the K-Spinner. What is it? What does it do? Why should a reloader *want* one or a set in the several appropriate sizes? Foosh, I thought you'd never ask!

A K-Spinner is a little mandrel, craftily contoured so a case can be pressed over its tip to engage with a friction-fit, at which point the case commences spinning also. As of that moment, the case can be modified in many useful ways. Resizing lube can be wiped off its outer surface with a rag or piece of paper towel. Blobs of crud and corrosion can be obliterated with a tuft of fine-grade steel wool. The primer pocket can be rendered immaculate by application of a small tuft of steel wool on the end of a bit of wooden dowel. If desired, brass polish, chrome cleaner or the like



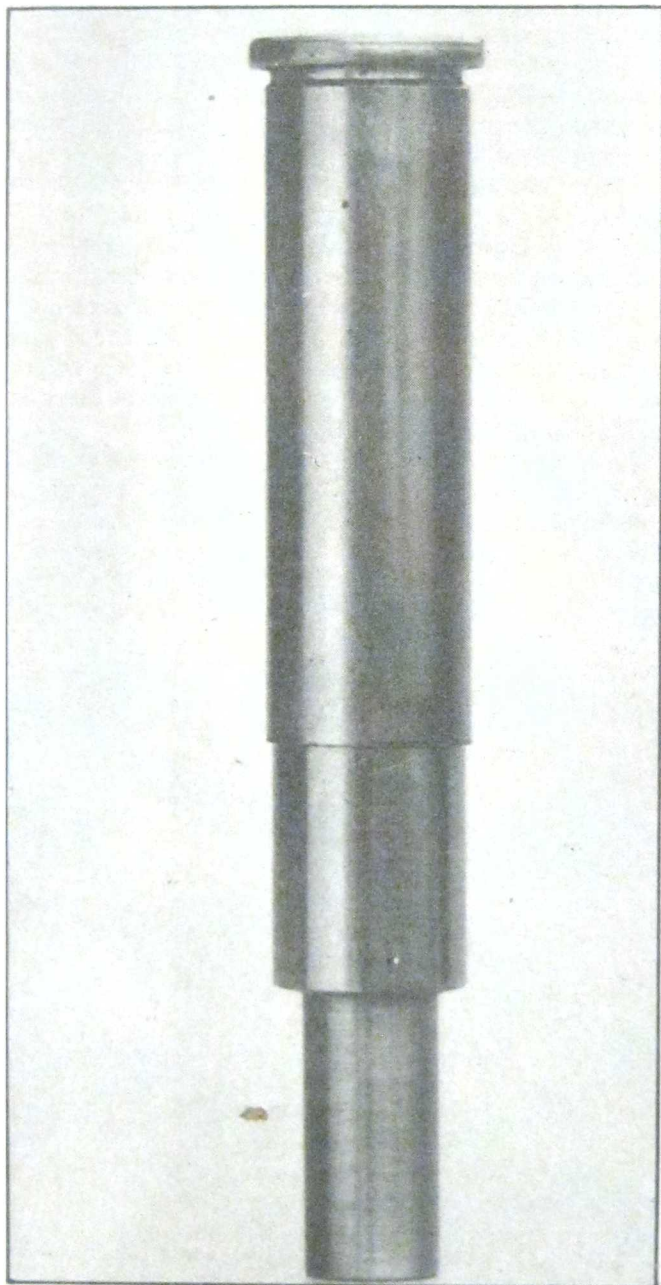
Here and on the facing page is a simpler K-Spinner in .38 size. The business end has just a very slight taper to engage the inside of the case mouth by friction.

can be applied with a piece of paper towel, followed by further wipes with a clean piece of paper towel or facial tissue to leave it sparkling like a freshly minted gold-piece.

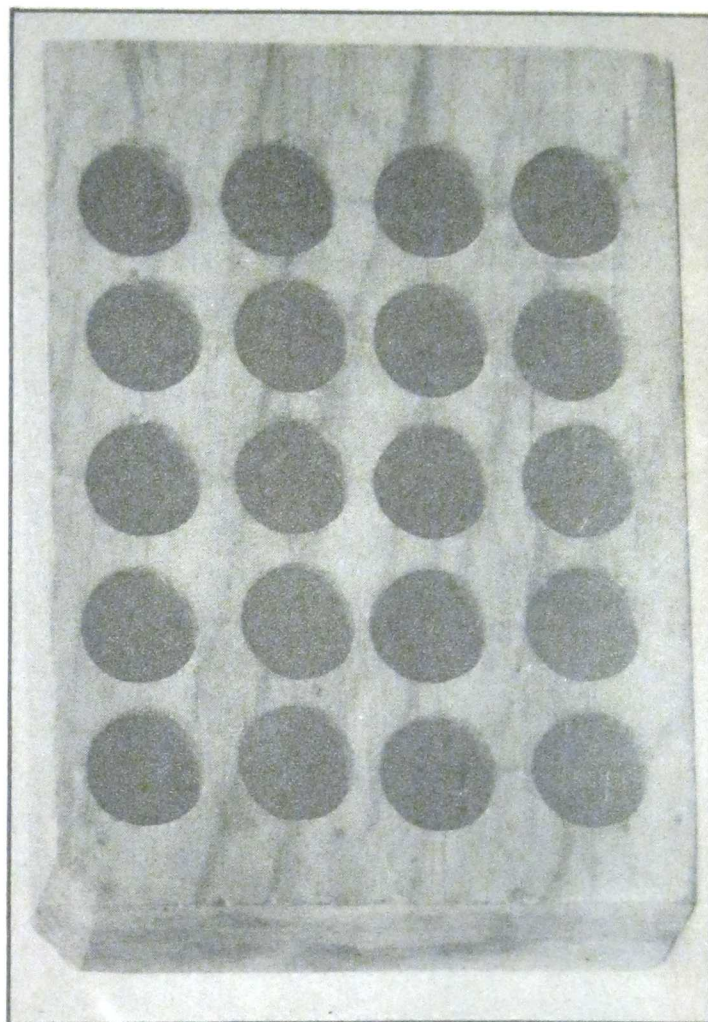
With the case well snugged into place and centered to eliminate wobbling, one can apply fine-cut files to reduce rim diameter, should that prove desirable, or a three-cornered file can be used to relieve metal just ahead of the rim so as to fit a shell holder that's a trifle chintzy in dimensions.

If you have a drill press boasting a ½-inch chuck, there is really no need to turn K-Spinners with ¼-inch shanks. You only need those if you're reduced to using quarter-inch drills, perhaps secured in a bench vise.

The business end of the K-Spinner needs to have some



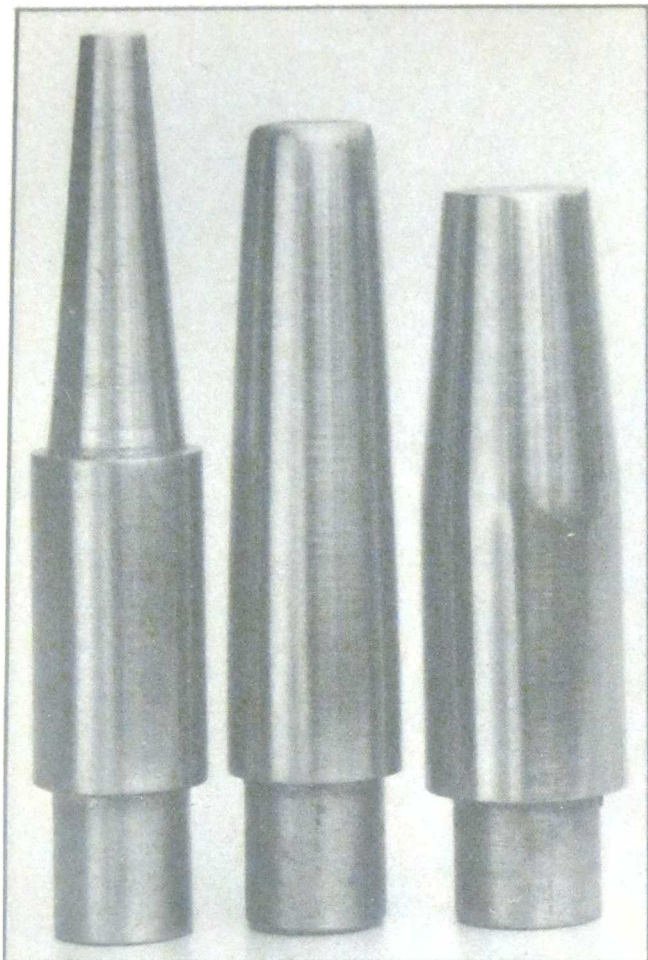
An as-fired case comes to rest like this. Resized cases will be gripped at a somewhat shallower depth.



There's no such thing as too many loading blocks! This is a simple affair, made from shop scrap wood, with twenty ½-inch holes for .45, .308, etc.

small amount of taper, so the case mouth will slide onto it and encounter a friction-fit some little distance later. That can be done nicely on a lathe by adjusting the compound head for a angle of half a degree or so. It can be done just about as well with a flat file, delicately wielded.

It appears that this much can be stated with certainty: If you want a K-Spinner, you are going to have to make it yourself. Nobody is going to produce it for sale at your local emporium of reloading needfuls. For the past couple of decades or so, I've been hell-bent on trying to inveigle some entrepreneur into offering them commercially; all in vain. I've even made up marvels of the art that accommodate three or four different calibers in stepped sequence and laid them off onto likely prospects but (sigh!) all to no accomplishment. It does not appear to be a commercially enticing artifact. It is, withal, an artifact so starkly utilitarian that I use my collection of them hundreds of times in any given year.



Above is a set of what I call case-neck coaxes, with $\frac{3}{8}$ -inch shanks for use in the drill press. Tip of the smallest is .172-inch and it works well for ironing out stamped primer pocket crimps from .223 military cases.

What's so great about the K-Spinner? Simply this: Once it's spinning, you press a case onto it by its mouth and process it and pluck it off, still spinning, and slap another into place and take care of it, pluck it off and so on and so forth. There is no need to shut off the power between cases. It can also be used to wipe off the outside burr after case trimming by application of a tuft of fine steel wool to the neck area.

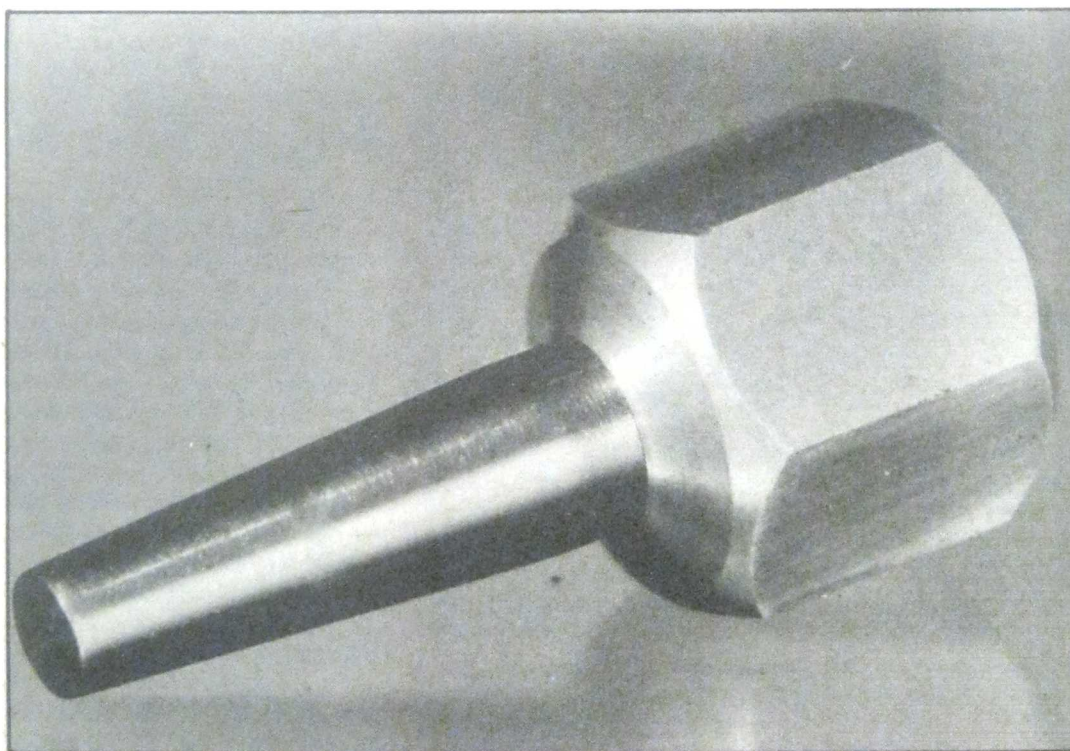
You wish to color-code cases for any specialized requirement? Just put the case on the K-Spinner and apply a felt-tipped marker in the desired color to the side of the case to put a neat ring of color around it.

The useful applications of the wee gizmo appear to be all but endless and I hardly feel I've plumbed its potential in a couple of decades of grateful use. The only grinding fact appears to be that you've got to make your own. None of the friendly, helpful manufacturers appear to be in the least inclined to do it for you. The hitch appears to be that it's so easy to make that anyone can make it and thus, no one is apt to feel inclined to lay out \$3.50 or \$5 a whack for the little gizmos.

I regret and apologize if I seem to sound embittered on the topic of the K-Spinner. It is just that I think I've discovered an indispensable gadget for reloading and have battered my head to the bone and beyond in totally vain attempts to get anyone at all to put it on the market. If anyone wants to try making them, they're welcome to the concept and the zitzzy designation. No royalties are entailed. Just pass me the word so I can tell the world where they can be purchased, ready-made, okay?

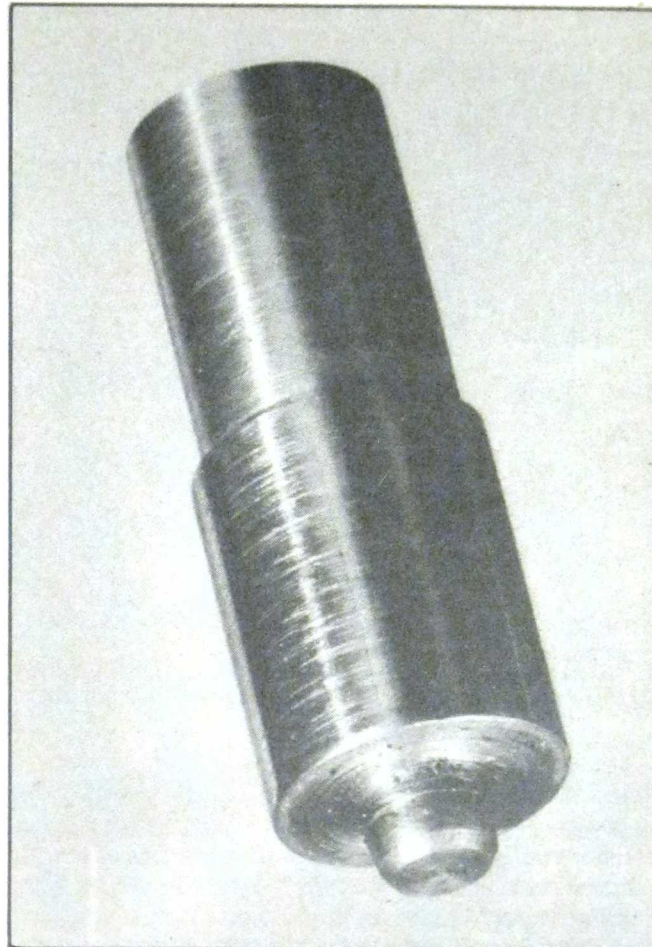
I'm aware that not everyone has access to a metal lathe, but that some do. Illustrated is a set of three specialized punches that range from caliber .17 to caliber .45 and a bit. These are designed for use in a drill press and, again, they are just plain addictively handy. To produce these, you need either a metal lathe or a drill press and a vast lot of

A similar coaxer has been fitted with a handle of aluminum hex stock for use in the hand. Such gadgets are very helpful for getting a reluctant case mouth flared to accept the bullet.





Two views of another homemade punch for swaging the stamped crimp out of military primer pockets. It operates in the drill press, with table braced as discussed. The case is supported by a short piece of 3/16-inch rod mounted on a base clamped to table.



patience. The business end is tapered five degrees on a side or with an included angle of ten degrees. The upper shank end is about .375-inch diameter, butting into a shoulder at the full half-inch diameter. The smallest size — dimensions as noted — serves as a primer pocket swager for small-rifle primer pockets to get the stamped-crimp out of military small-rifle brass, such as .223 Remington, on a suitable support mandrel. The entire set will serve handsomely to put a bit of added throat in a case neck to ease the seating of a bullet base.

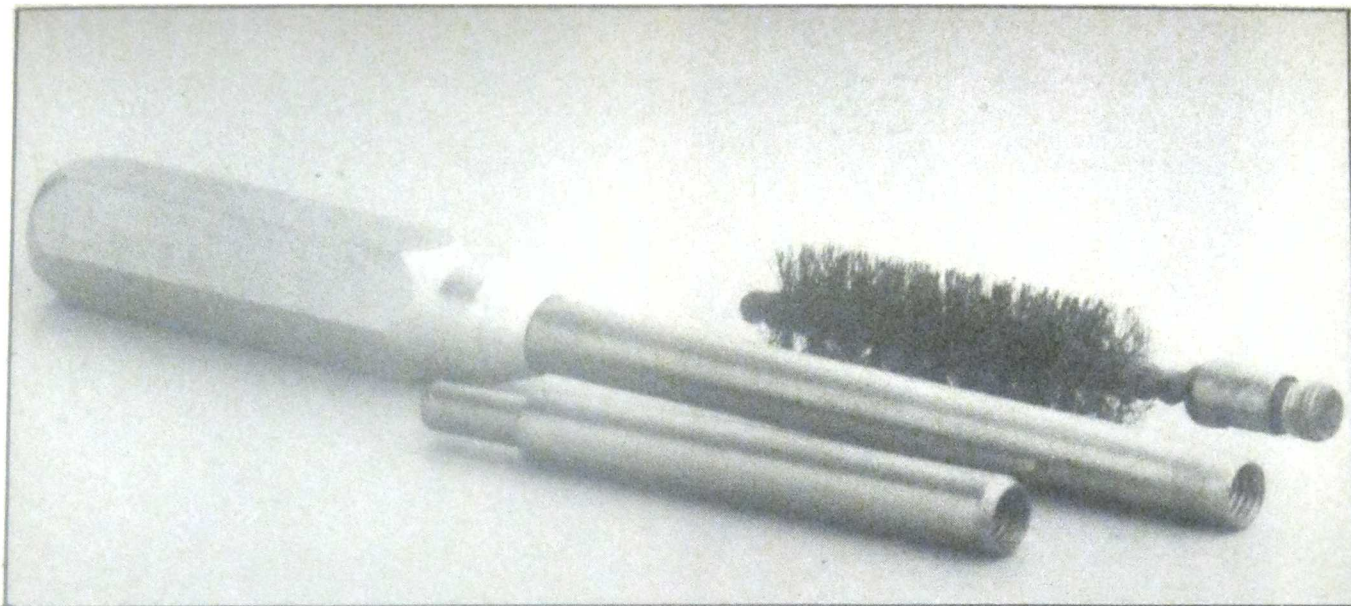
More, the punches serve to convert the humble drill press into a pretty decent, medium-strength arbor press. You cannot readily *believe* all the useful applications that they make available. When used in this fashion, I usually install a bracing of pieces of scrap wood or the like between the base of the press and the lower surface of the movable table to absorb the stresses involved and prevent the movable table from snapping off.

Some time ago, I made up a small hand-decapping kit consisting of a punch that can be installed in the chuck of the drill press and a support base that accommodates most if not all case head diameters. It has proved to be extremely handy on a number of occasions.

As but one example, I still have a number of .44 Special cases on hand that date from the middle Fifties, if not



If you can find the good stuff, Titebond glue is the best I've ever found for fastening wood, Masonite and similar materials used in constructing shop needfuls.



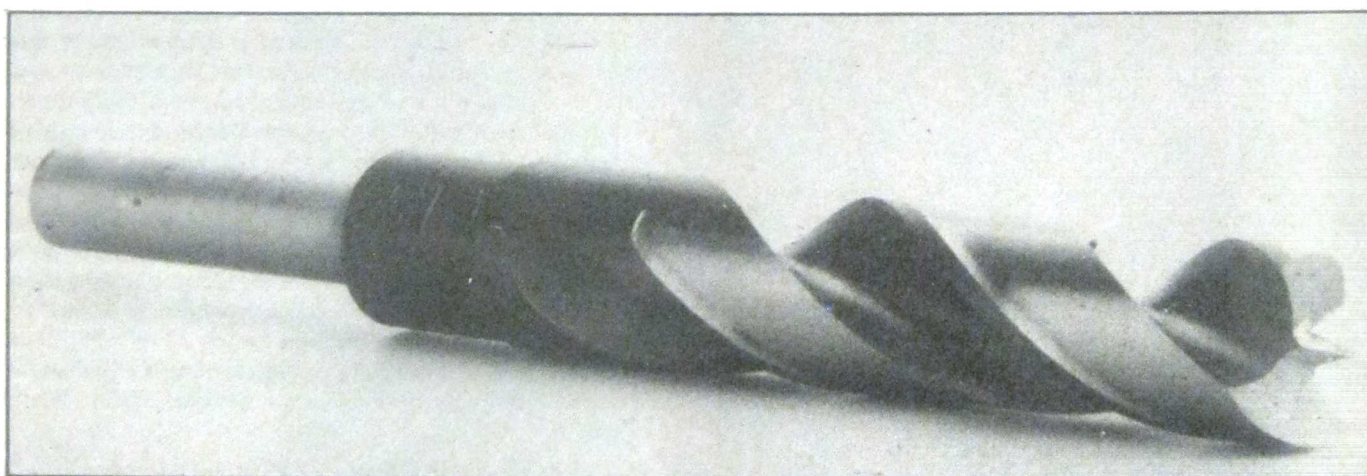
The thread on this shotgun cleaning brush is 5/16-24 and the handle is convenient when working to get the choke at the muzzle good and clean. Shaft in foreground enables brush to be powered by an electric drill.

earlier. They are of Winchester-Western make (W-W headstamp) and have flash holes of somewhat smaller diameter than modern cases. If you decap such a case with a modern resizing/decapping die, it seizes the pin in a firm grasp and wrenches it out of the holding collet. If that happens, I remove and replace the pin, then check to see if I have any other fired cases that retain the old, small flash holes, set them aside, use the hand decapper to knock out the spent primers and ream out the flash holes with the suitable size of drill. Full details are given in the captions of the photos.

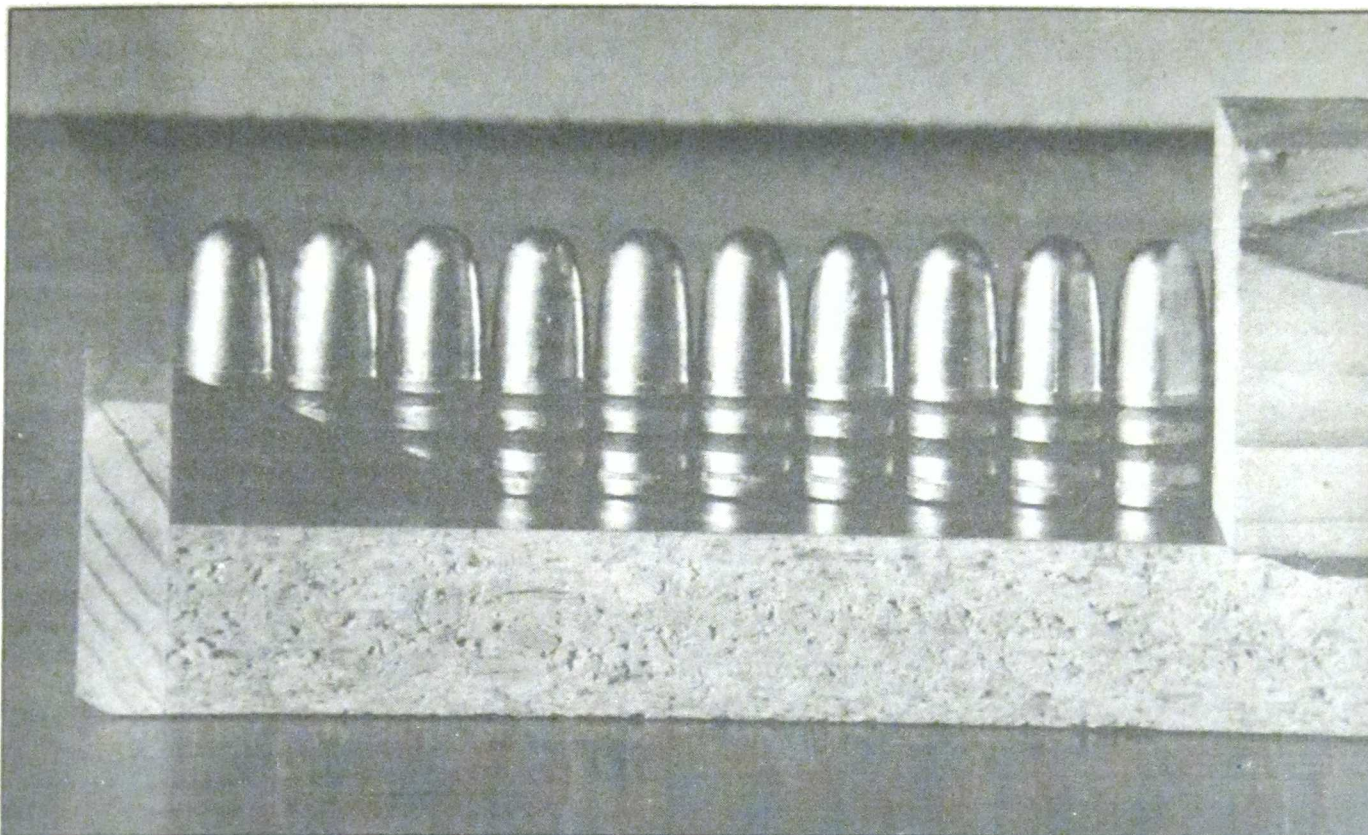
Admittedly, this is a problem most reloaders will not have to face; only those who have been reloading the .44 Special case for the better part of thirty years. It illustrates, however, the way that specialized, homemade equipment can be helpful.

Reloading seems to foster an insatiable thirst and demand for small handy containers to hold bullets, cases and all sorts of other small but vital artifacts. The three small shallow boxes in which sheet film is supplied in the 4x5-inch size work extremely well if you've access to those. If you don't, as is often the case, similar small trays can be made up from Masonite pieces and aliphatic resin glue to any dimensions that seem desirable.

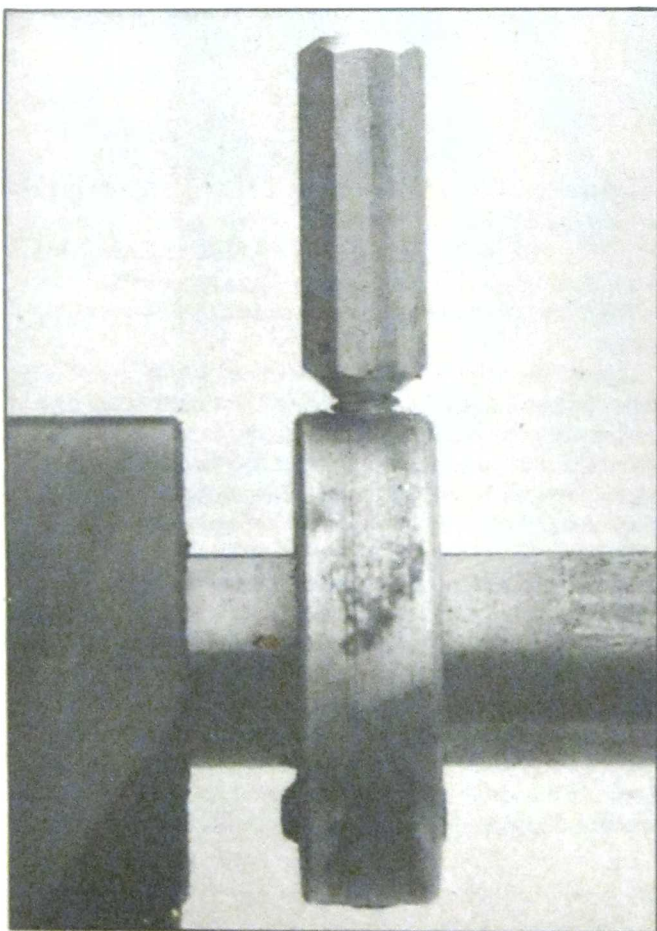
The best general-purpose glue I've encountered to date is a brand called Titebond, but it is damnably difficult to locate a place where one can purchase the good stuff. A reasonable substitute is the Wilhold brand in the pale, creamy yellow color that marks the aliphatic resin version. The white glues are considerably inferior in setup time and holding tenacity, I've found. The yellow glue from Borden's, under the Elmer's brand is the least satisfactory, in



Cartridge loading blocks require a 9/16-inch drill bit for the sizes such as .44 magnum and it's rather hard to find a nice brad-point bit such as this one. It's a standard metal bit that was reground by Ron Perry, 471 Pittsford-Henrietta Townline Road, Henrietta, NY 14467. Perry can do the same with most sizes.



This little measuring device I rigged up to determine the exact dimension needed for the bottom of trays to hold bullets in rows of ten or any other desired number. The block at the right is movable and can be C-clamped in position. There is hardly anything as aggravating as finding such a tray won't quite hold ten!



my experience, although it seems to be universally available.

It is often advantageous to make up trays dimensioned so that a given caliber of bullet will nestle snugly, ten to the row, with perhaps fifty, one hundred or two hundred as the total tray capacity. That involves precise dimensioning of the basic tray bottom. It does not often work to presume that since the bullet diameter is .410-inch, 4.100 inches will serve nicely.

What does work is to make a little measuring device on which you can place ten of the bullets under consideration to determine the actual width needed. In measuring, it is best to add the thickness of one or two pieces of 3x5-inch file card for tolerance. All too often, if you try to measure to the last Angstrom unit, you end up with a tray that won't *quite* accept ten bullets in a row.

I need to keep reminding myself I'm not quite a typical reloader. I'm a reloader who writes about the subject and, as such, I do not always go on and consume my by-products promptly. On hand are bullets, slugs and round balls cast anywhere up to a quarter-century ago, if not longer. They are kept around to serve as models for needed illustrations.

My reloading area also serves as a workshop for doing woodwork projects, machining, photography and what-

This is the stop collar on my hard-working Forster case trimmer, fitted with a small homemade thumb screw in place of the usual hex-socket screw so I can adjust it without having to hunt for an Allen wrench.

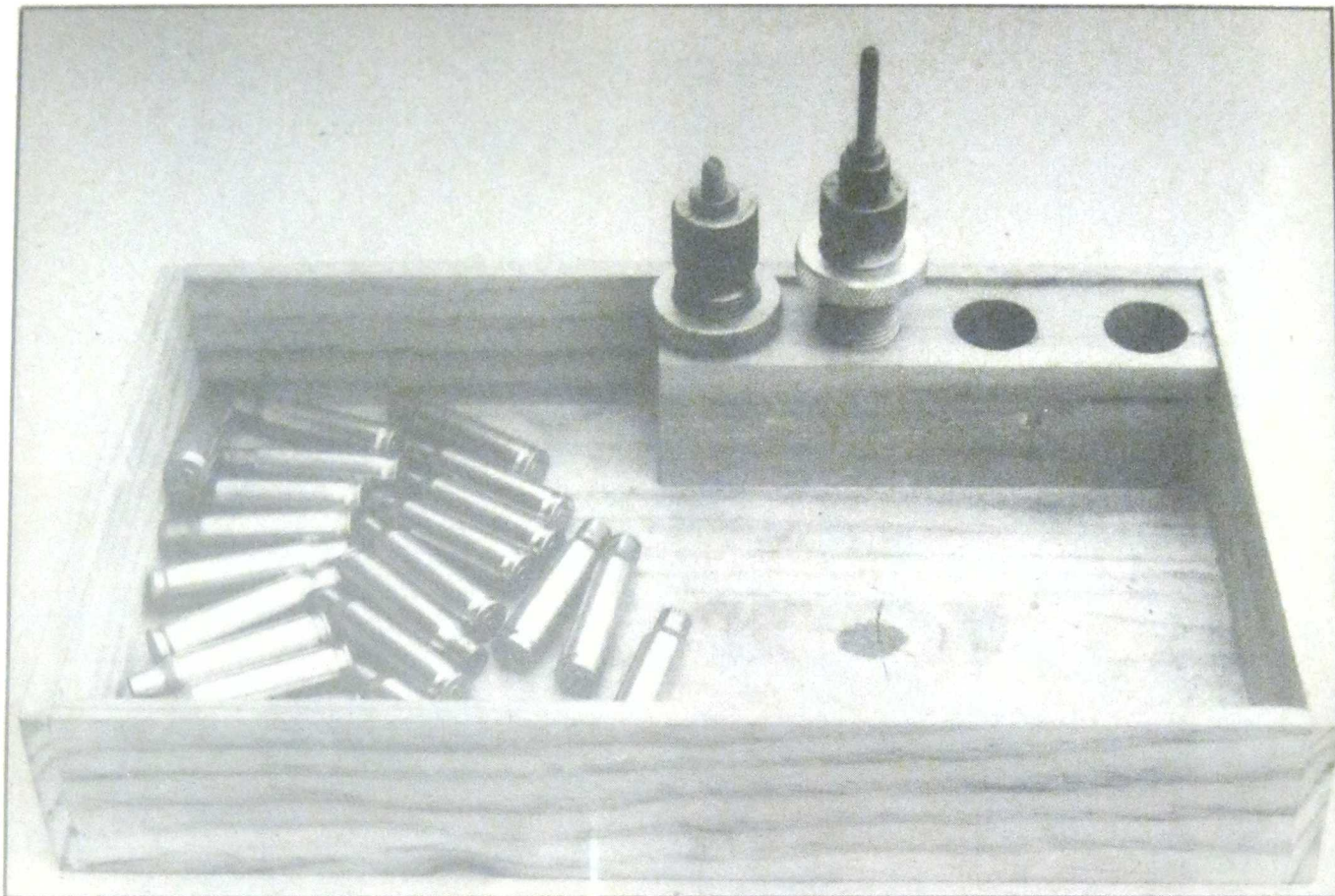


Diagram illustrating the use of the dies — 308 Win. in this example — next to the loading area. The tray box on the other side of the tray holds the cases after processing. This one has a small hole bored with a hand drill — handy for loading dies as a further convenience.

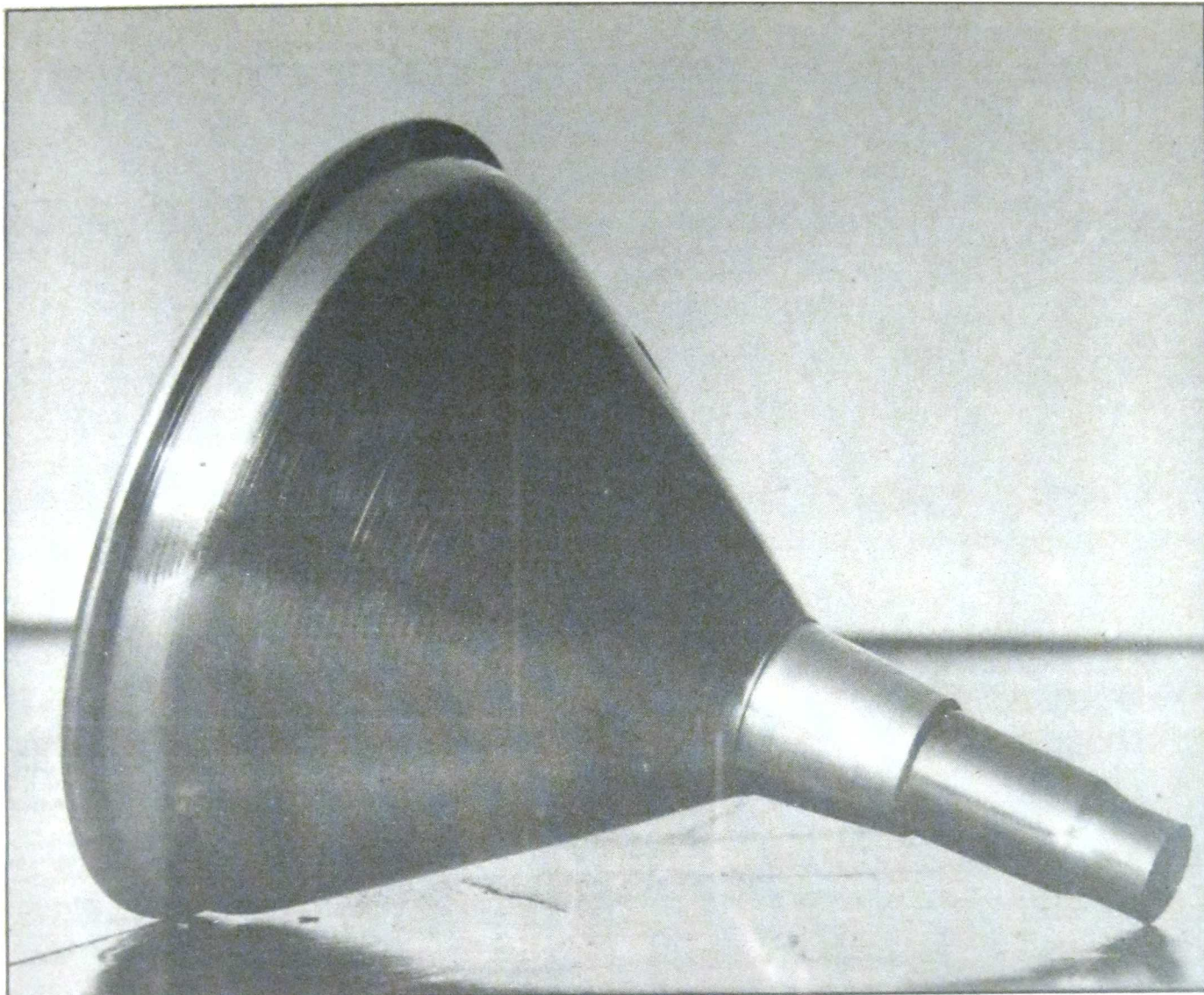


Apart from the small homemade hammer and center-punch, most of these items are used in the drill press for some operation or another and the tray reposes on a shelf beneath the useful machine.

ever else needs doing. The sawdust and sanding dust from woodworking is particularly obnoxious in its fallout properties. It sifts down over everything and, as it gets to the floor, it mingles with webs spun by the ever-present spiders to form one of the most noxious types of pollution imaginable.

Departing briefly from the nominal topic, I can note there is hardly anything quite so nice and handy as a resilient surface underfoot. The shop floor is of concrete, about the most unforgiving surface to be had. I've covered parts of it with scrap carpet and the mudflaps of trucks retrieved from city streets. A case, a die, a bullet or loaded round incautiously dropped can be picked up and salvaged if it falls upon such a cushioned surface.

Just last night, by diabolical mischance, the body of a Nikon Model FG camera got loose and crashed to the floor in the miniscule darkroom of the shop, which is *not* padded. I'd tentatively guesstimate the damages on the order of around \$125 and yes, that's nearly the cost of a new body. So it goes. Meanwhile, the fondly regarded FG is off the line for an indeterminate while and illustrations for the next few chapters will have to come out of the Nikon F3/T



Sometimes you need to bush-down a funnel and the front portion of a case can be held in place with Loctite

body and yes, I'm grateful I have that for backup and yes, I'll handle it with exaggerated care and solicitude!

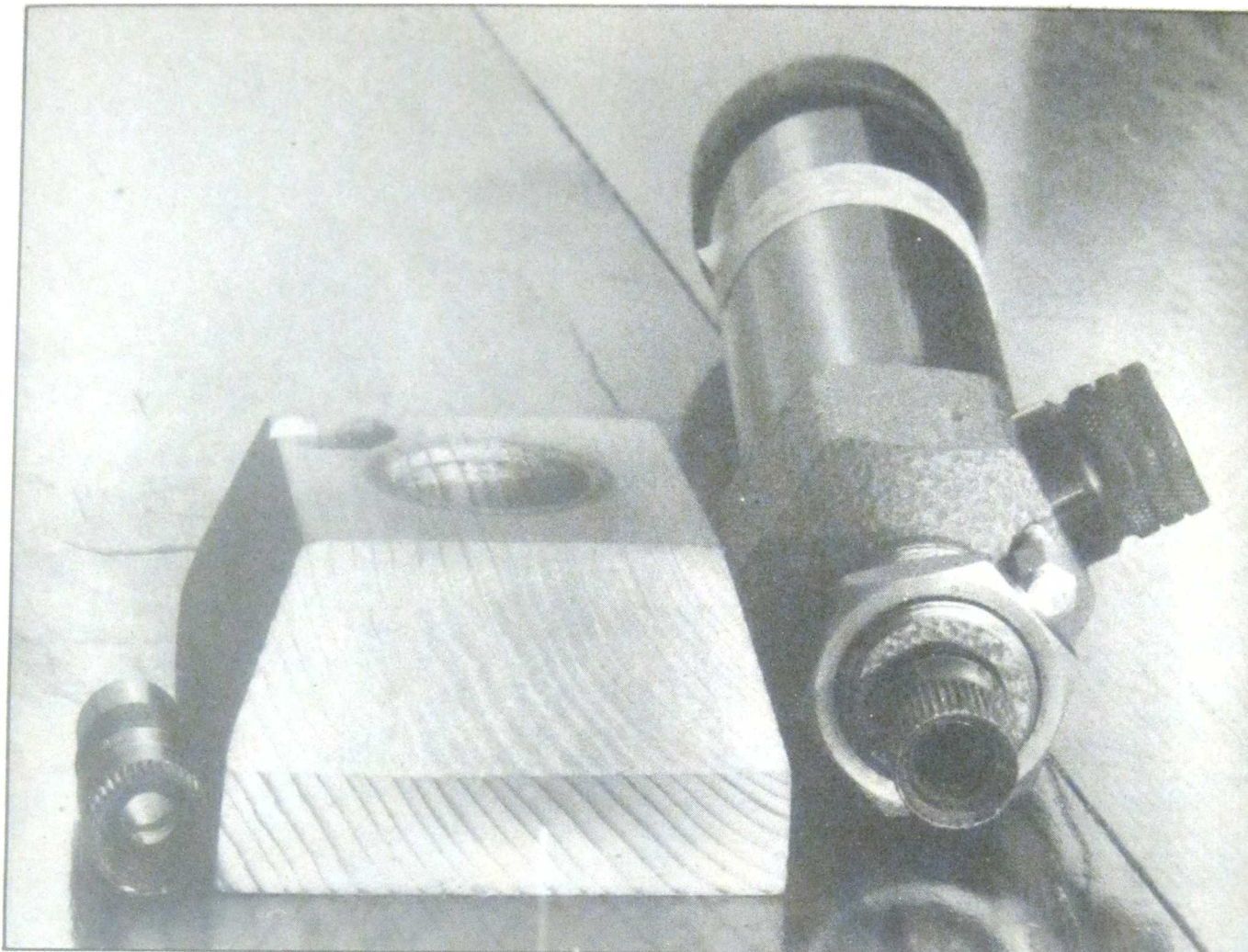
The point toward which I've been tacking in all this is that once you've cast and lube/sized a nice batch of bullets, you need storage facilities to keep them in top shape until loaded and used. A tray of the right size does a good job and a piece of light cardboard, cut to dimensions, will serve quite well to keep the dust and other debris off of them. I've made a storage pagoda of sorts that accommodates a whole bunch of storage trays and will toss in a photo of it, if possible.

It is awfully handy to have a few fair-sized boxes into which you can dump the cases being processed as well as the cases after being processed, to be located on either side of the bench next to the loading press. Toward that end,

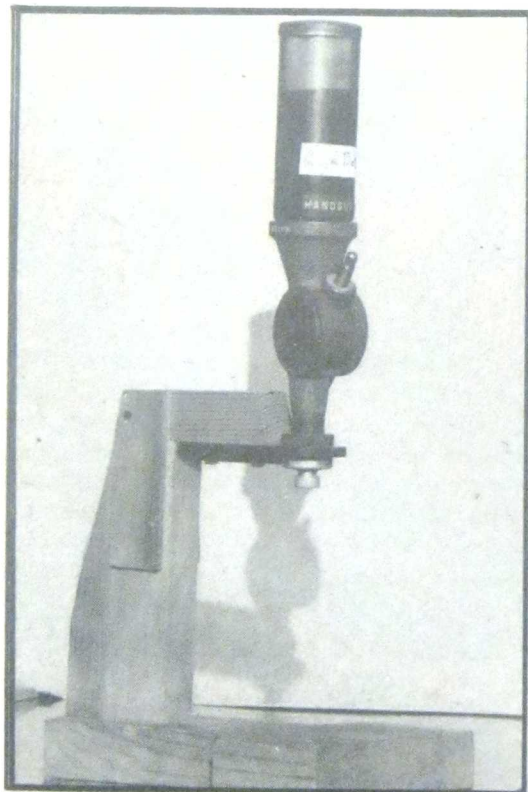
I've been forced to re-invent the cigar box and will try to include a few illustrations of such affairs.

These are made from wood of opportunity, planked-down on the table saw and edge-glued as necessary. The adhesive is still the admirable Titebond, as obtainable. One such artifact has a small block glued in the corner with some $\frac{1}{8}$ -inch holes bored in the top to hold loading dies not in current use but apt to be needed in upcoming operations. This has worked out to be a pretty good idea and I commend it to your consideration.

Before RCBS finally got around to making up their dandy little rack for shell holders, I felt the need for something along such lines and whomped forth the board that may be shown here. Maintaining convenient control of and



Above is a base for the RCBS Little Dandy measure, with a socket to hold the spare delivery nozzle. At left is a homemade stand for the RCBS Uniflow measure. Its base is T-shaped to prevent tipping

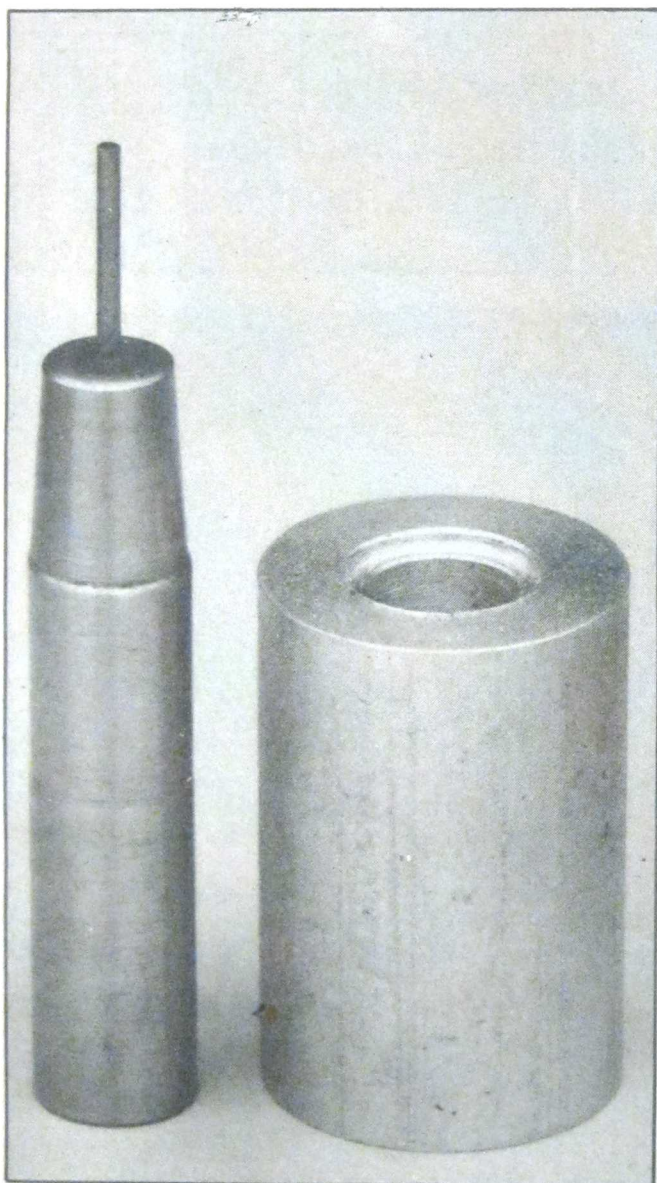


access to shell holders is an important aspect of reloading efficiency.

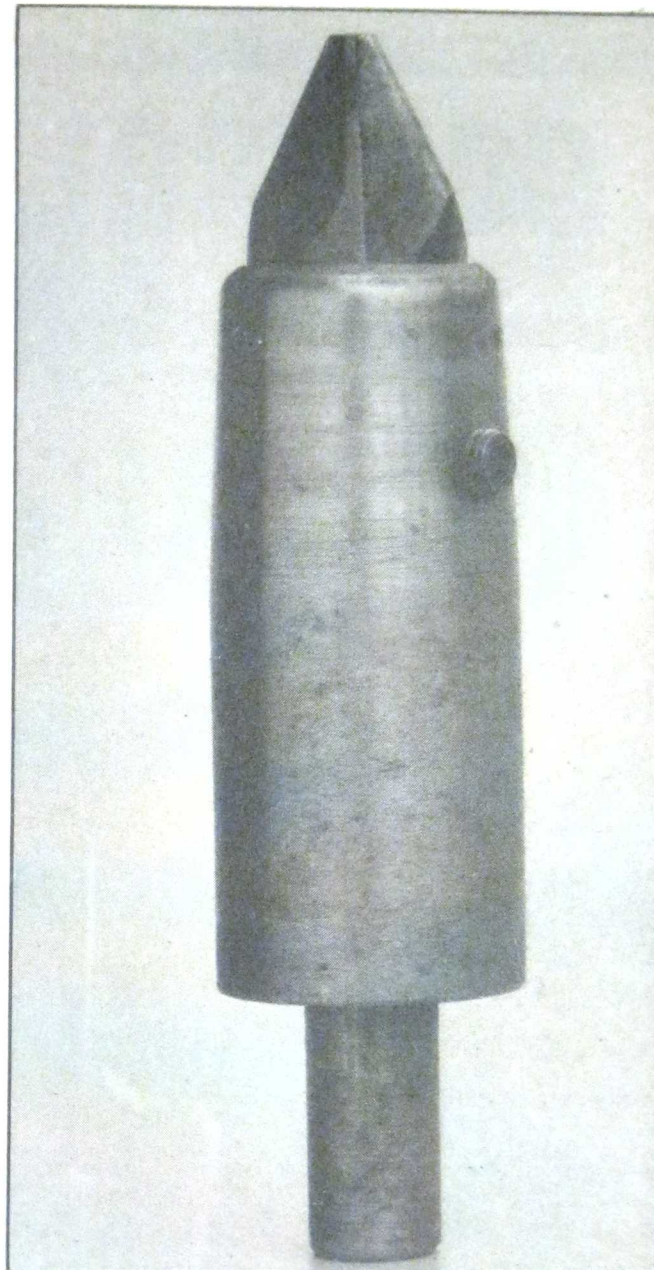
It was noted earlier that I like to attach presses to small hunks of two-inch plank by means of bolts countersunk from the underside to keep them from interfering with C-clamping the planks to the loading bench. Most such presses are accompanied by small supporting hardware such as primer seating punches and collars that is just a plaguing devil to keep track of. My solution for that is to obtain a few empty plastic boxes with self-snap covers and attach those to the upper surface of the plank in a handy place to keep track of the small parts. This, also, has seemed to work out well and I commend it to your consideration.

Most, if not all powder measures come from the maker with little or no holding devices and you need something of the sort to utilize them efficiently. The illustrations should include some examples of my personal solutions to this minor perplexity. The RCBS Little Dandy measures, which I find addictively convenient, still need a small holding block for storage when not in use and it's helpful, if it has a place to park the delivery nozzle not in current use. Again, photos of such things should appear nearby.

In final summation, a decent workshop can serve as elegant support to the reloading enterprise. Up the line, we'll be showing and discussing the remarkably neat gizmos that were schemed up to take care of bullet seating to absurd levels of precision. Those are only a further example.



A handy little hand-decapping punch and base, in a size to deprime .44 Special cases having undersized flash holes. It finds many other uses, too.



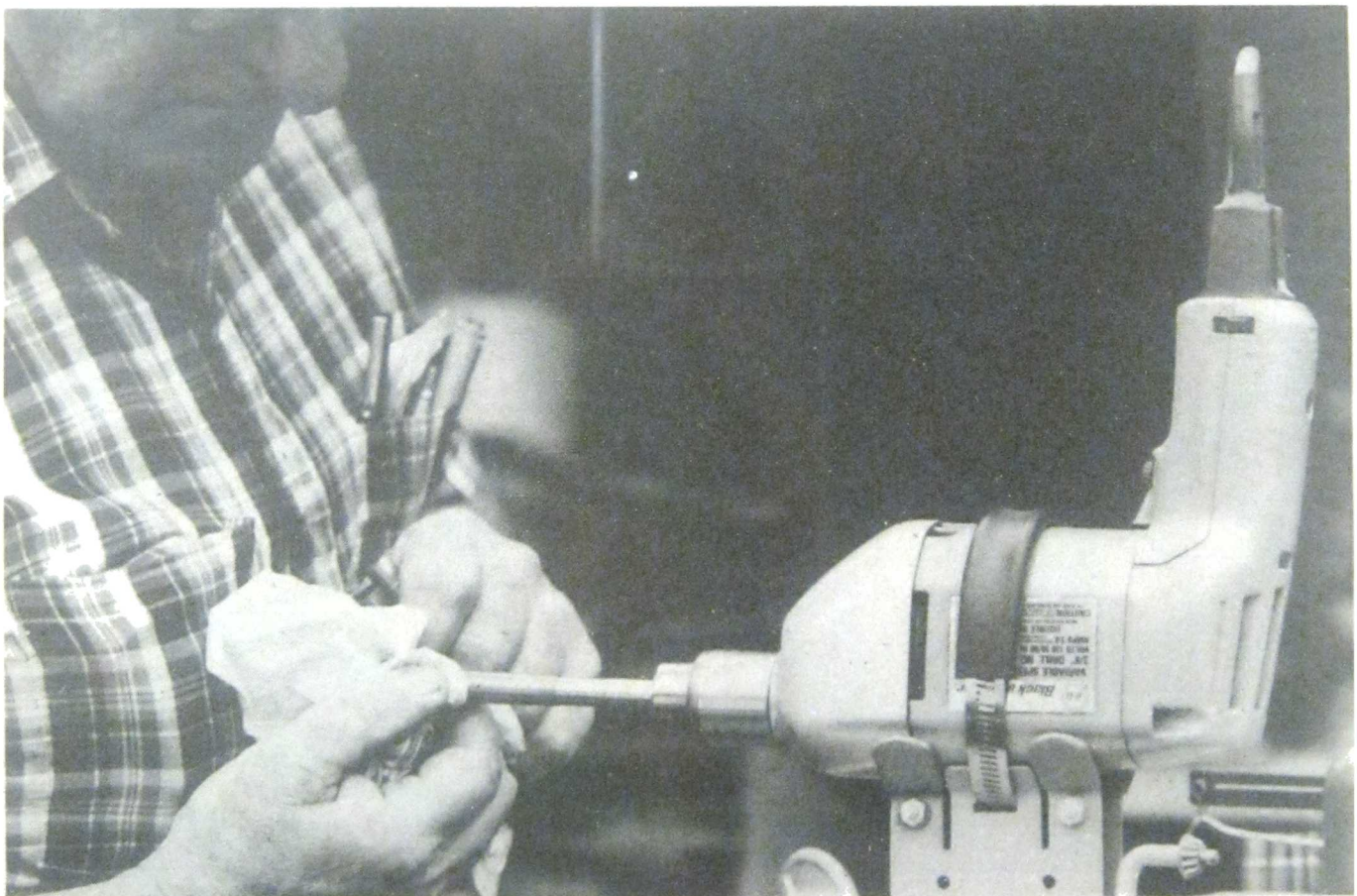
A homemade adapter to hold an inside/outside case neck deburring tool for use in the drill press. It needs to be operated at a slow turning speed.

What I've been striving to illustrate and discuss is that the typical reloading enterprise can be enhanced and enriched most usefully if it's backed up by a workshop junkie outlook of the sort described here. No pretense is made that the possibilities have been given and explored *in toto*. Rather, I've tried to show you the mental mind-frame that seems to work well under the peculiar circumstances. It is my hope that someone reading this will see still a further devious and crafty way to go and that he/she will write and give me the details so I can include them in ABC/R4 or whenever.

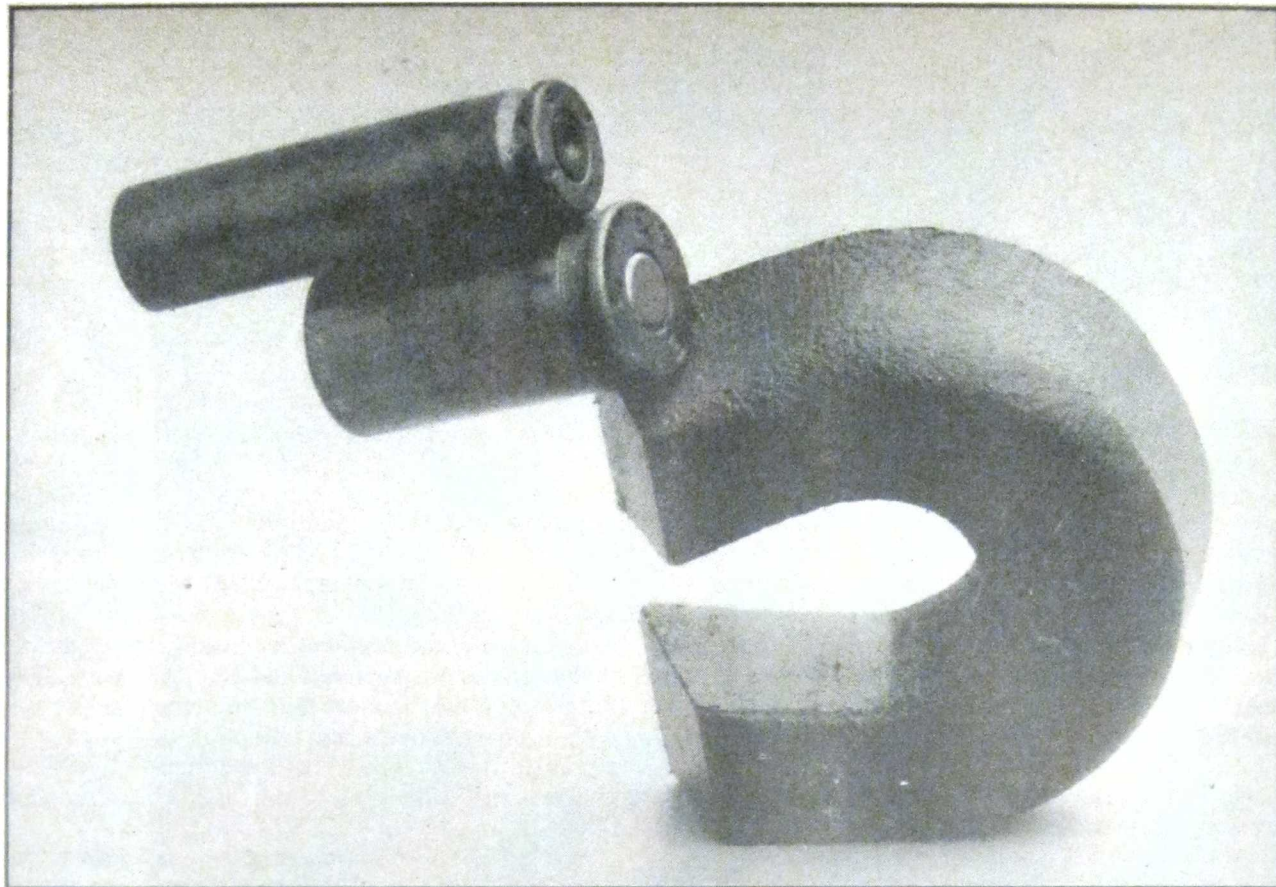
Work smarter, not harder, is the ongoing motto to live by, in my humble opinion (imho)!

CONTROL, STORAGE AND HANDLING OF EMPTY CASES

The Average Reloader Handles More Cases
Than Sherlock Holmes Did In A Lifetime—
Here Are Some Notes On What To Do, And Not Do!



Even if you don't have a drill press, an inexpensive stand for a hand drill, such as this one by Black & Decker, makes a handy way to power K-Spinners for removing resizing lubricant.



Most steel cases, such as this .30 M-1 carbine and .45 ACP, are relics of WWII. It can be argued whether or not they have useful employment but they should be sorted from brass cases.

THE EMPTY CASE is one of the most important artifacts around the reloading bench. As has been noted, it represents one of the most vital components of the original factory cartridge and it is the one single thing that makes reloading practical, economical and, for good measure, addictively good fun.

The whole business becomes magnificently simple if you only reload for one or just a few calibers. That is how most of us start out, but we keep on retrenching, broadening and subdividing and, as the genie remarked to Aladdin, "that's where the rub comes in."

When you reach the point where you can and fairly often do reload for some thirty or forty different cartridges that are fired out of handguns or rifles or perhaps some examples of each, the logistics of it all tend to become rather formidable. You may not have reached this stage yet, but I've some helpful comments to offer against the day you do.

First of all, there is the matter of recovering the spent cases at the time of firing. With revolvers, bolt-actions or single-shots, that's a fairly simple matter. With autoloaders, be they handguns or shoulderguns, it is another proposition entirely.

The autoloader, you see, ejects its empty fired case and many do so with a noteworthy degree of verve, alacrity and enthusiasm. In that context, I am thinking of an otherwise admirable little rifle I have: the Ruger Mini-14 Ranch Rifle. If fired from the bench, with the action about a yard off the ground, the spent cases come to rest perhaps thirty or forty feet away, roughly four o'clock from the point of firing.

That is an extreme example, but a lot of the others are

nearly as exuberant. If you can't put hands upon the ejected empty, you can't make a live round out of it for further enjoyment; just that icily clear and simple.

First of all, it helps if you select your firing site with canny care. Given a rough notion as to the fallout pattern of the fired brass, you arrange for it to drop onto a stretch of terrain where it will be as easy as possible to spot. Smooth concrete is about the best and fine gravel about next after that.

As you fire it off, plan to arise every five or ten shots and do an exhaustive policing of the spent brass. Strive for eighty percent recovery, if not better. If the ejected cases are of an exotic and valuable nature, as in the example of highly modified persuasions such as the .38-45 Clerke, you may wish to extend that to one hundred percent recovery before resumption of firing.

Something I've found helpful along such lines is a spin-off of another endeavor. That is by no means uncommon nor unusual. This gadget started out as a helpful aid in taking photographs. I do a lot of that in normal routine. It consisted of a piece of light plywood, about two feet on an edge, sprayed on the front with bright aluminum paint to serve as a reflector that could be beamed-in to good effect to pick out highlights and vital detail. A bracket on the back mounts it to a tripod. I called it my solar-powered fill-flash and several examples of its useful work will be found in the volume at hand. Along the way, I discovered it served just about as well as a deflector of energetically ejected empty cases. It's just a matter of setting it up to catch/deflect empties from an autoloader, which may put small dings and dents in the silvered surface, but without affecting its useful performance in its original role.

I've never tried it, but I think it would work quite well to hang a large, fairly heavy beach towel or something of the sort vertically, from a height of six feet or so, suspended from a crosspiece support that could be moved so as to intercept most of the flying cases. High winds would be a problem, of course.

I've seen another approach tried and that one doesn't work at all well. That used a large sheet of plastic, about five mils in thickness, and the problem stemmed from the fact that the ejected cases were more than hot enough to melt their way through the plastic at the instant of contact. Worse, in so doing, some amount of plastic was deposited on the cases and proved the very devil to remove later.

I have seen and tried small case-catching attachments that fasten onto the pistol, usually by replacing the RH grip slab or stock so as to position the mouth of a small funnel-like affair in relation to the ejection port, with the cases going on down into a bag that can be removed for final disposition. Some of these devices will catch the occasional case, but their average does not seem impressive and their price seems inordinately steep in view of the actual gadget.

A friend in England, John D. Ellison, writes that his pistol club uses an old chute canopy for catching ejected cases and reports that it works quite well. I note that in the event you happen to have access to an old chute

Another handy item is some manner of container for holding the empty cases at the firing site, for later transportation back to the reloading bench. For such purposes, I find it works well to cut the tops off of quart or half-gallon milk cartons, rinsing them out and letting them dry thoroughly before use. Assorted tin cans of suitable size work equally well.

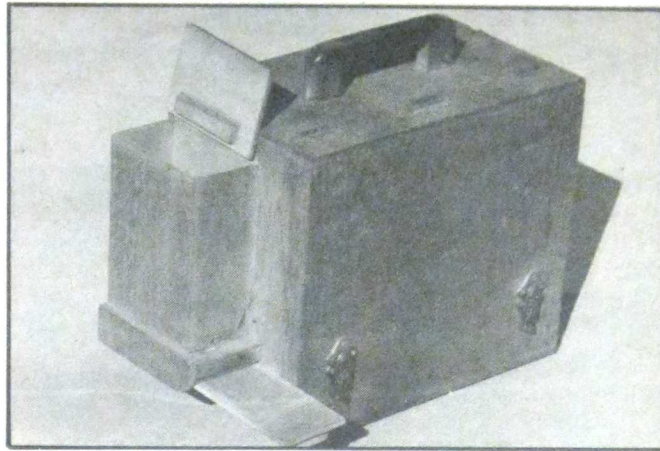
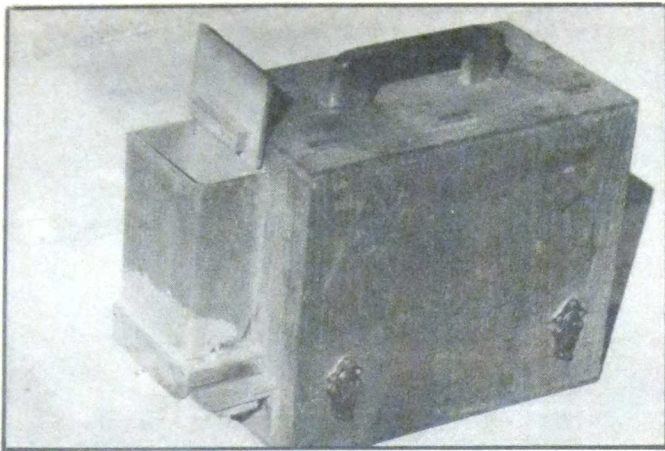
Once, many years ago, when I must have had much more time to spare for such things, I built a pistol case for Thursday night sessions at the gun club of which I was a member. I incorporated a novel feature I've never seen before or since. It was a holder for fired cases, about the size and general shape of a cigar box on end. It was glued to one end of the case, with a hinged cover at the top you could raise so as to dump the spent brass into it.

When you got back to the loading bench, you merely put a shallow cardboard box or somesuch under the holder and withdrew a fitted slide to let the cases jingle merrily forth. It really worked out quite well and if anyone takes a fancy to the concept, they're more than welcome to make use of it with my compliments and best wishes. The case is still around [*I think!*], unused in recent decades, and I'll try to include illustrative photos, provided it can be found in time.

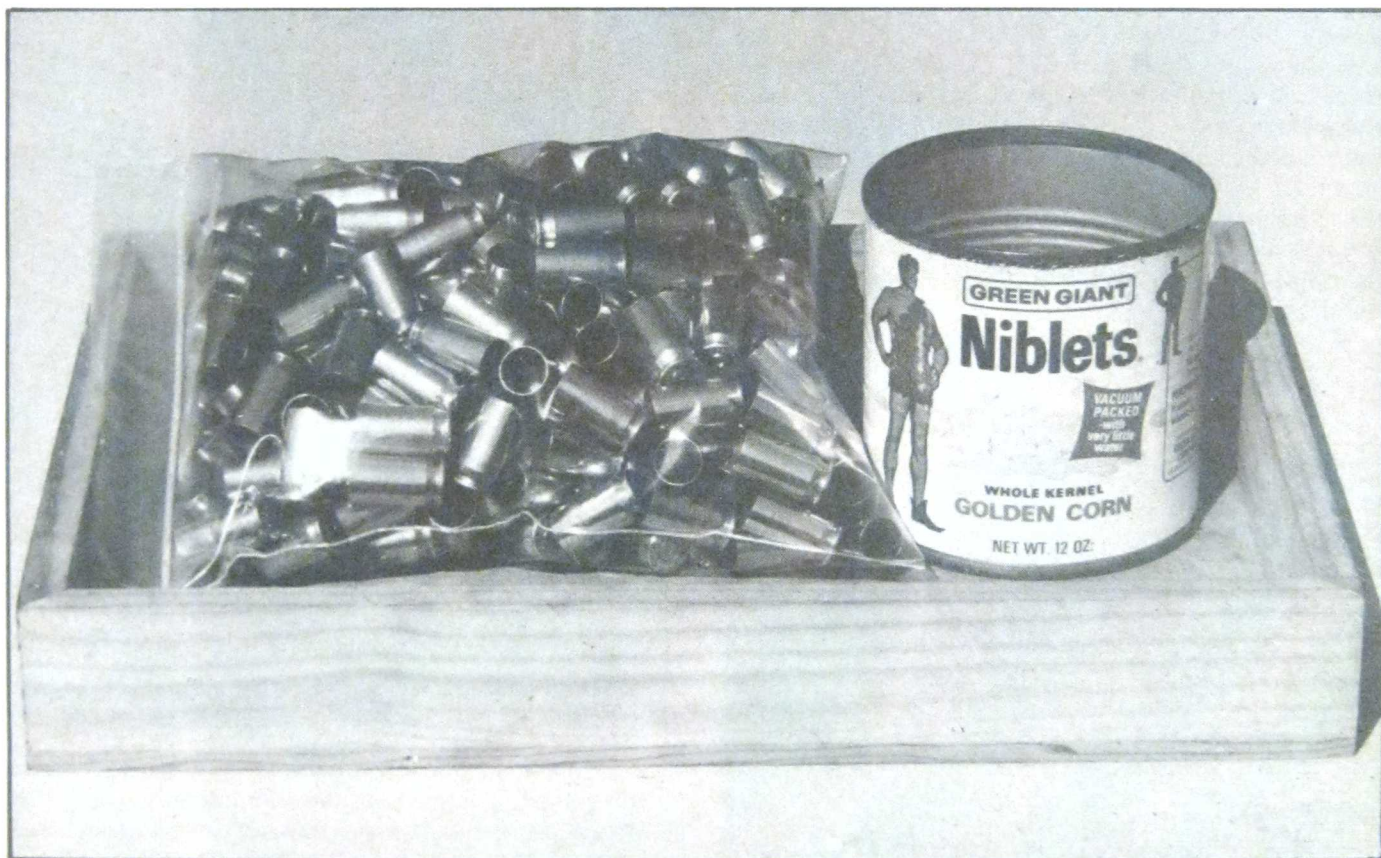
Having fetched your cases home, it's handy to have a fairly large flat tray for sorting them out as to caliber,



Empty quart or half-gallon milk containers can be rinsed and the tops cut off to create admittedly inelegant but helpfully functional boxes for fetching empty cases back from the shooting site. They also work well for sorting large quantities of cases.



Here's that old pistol case, built in the Fifties with a spent case container on one end to serve as a convenient way to get the brass back to the loading bench. Note the slide at the bottom that, when pulled, dumped the whole load into a box or tray. This seemed a great idea at the time, but I used to get some friendly ribbing from other competitors who wanted to know if I expected to get some mail.



Given access to a table saw, it's a simple matter to knock out handy little trays such as this one for sorting out cases according to caliber or headstamp. Shallow tin cans work well as sorting bins and the Zip-Loc Baggies protect cases during storage without concealing their identities.

headstamp and so on. A number of empty tins work well as sorting bins. In point of fact, I hardly ever discard the container from Niblets whole-kernel corn because they're ideal for such purposes but there are times when I ruefully survey the incredible mishmash of tins partially filled with this, that or the other and wish I hadn't retained quite *that many*.

Empty cartridge cases, as hauled back from the range, tend to be sort of maculate, meaning not immaculate. They are soiled with powder residue and, in the example — I try never to say "case" in cases such as this! — of empty brass from autoloaders, they will have picked up some amount of dirt, grit and foreign debris along the way. There is much to be said for giving them a pass through a case polisher at

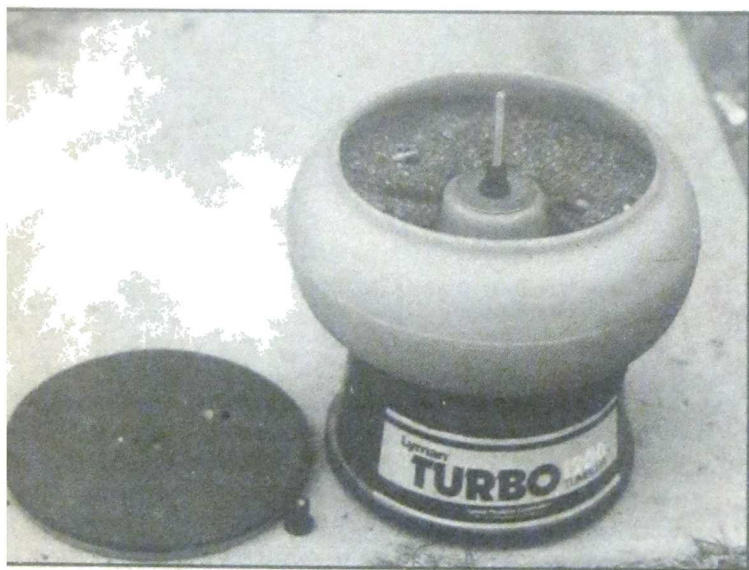
that point. Much the same cosmetic enhancement can be achieved with a K-Spinner and it's probably quicker if you're only dealing with a few dozen cases.

If you have some few hundreds of cases, however, the tumbler/polisher is definitely the preferred approach. Up to a certain point, depending upon the capacity of the machine, the more cases you process, the better it all works and it takes less time.

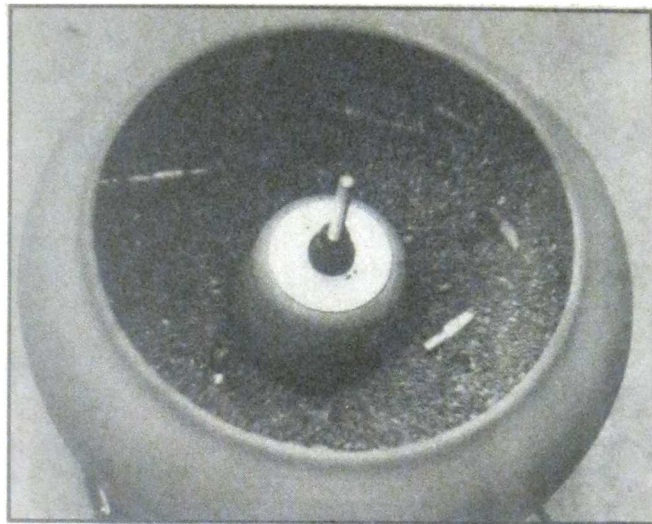
I will note an important consideration, hoping to spare you the odious rigors of learning about it the hard way: When you tumble cartridge cases, make certain all of the neck diameters are pretty much the same.

You can, for example, tumble/polish a mixed bag consisting of .380 ACP, 9mm Luger, .38 Colt Super, .38 Special, .357 magnum, .357 Remington Maximum (R-Max), .35 Remington, .350 Remington magnum, .35 Whelen, .358 Winchester and .358 Norma magnum and all you'll have to do when it's done is to sort them out by tribe and clan. Even a few .38 S&Ws will do no harm.

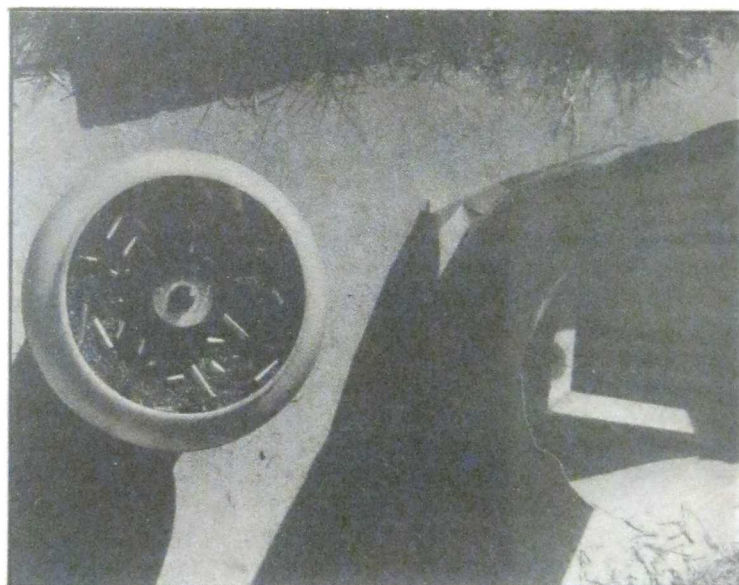
BUT...if you make the unfortunate *faux pas* of, for example, tumbling 9mm Luger together with cases either larger or smaller in neck diameter, such as .32 ACP or .44 Special, you'll find, when it's done, the small cases have wedged into the mouths of the larger cases, with polishing media locking them so solidly into place that it's an absolute puppy-mother of a job to get them apart. It requires patient application of scratch awls, needlenose pliers and eloquent verbiage. The sole consolation may lie in the fact that if you do it once, you will probably not make the same mistake again.



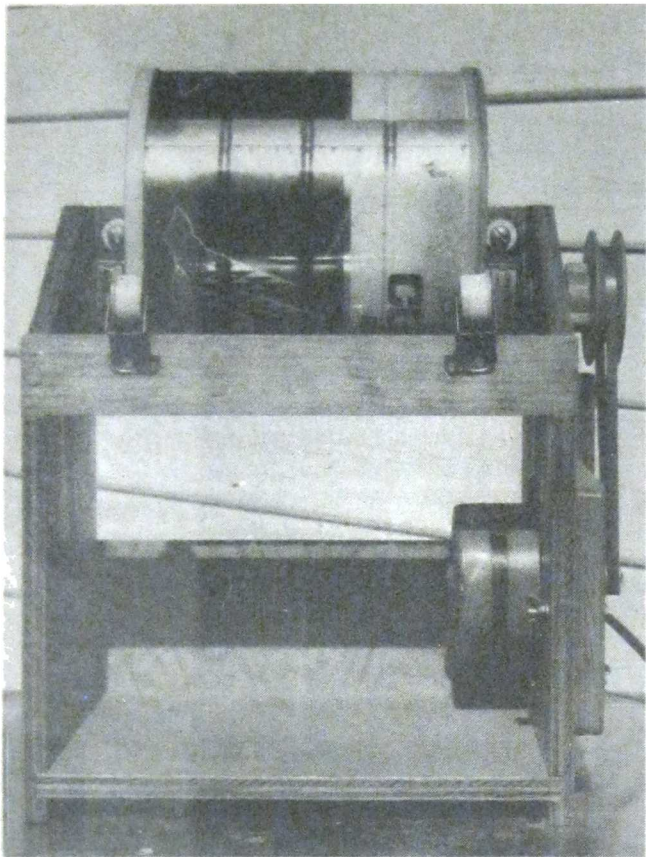
Lyman's Turbo 1200 Tumbler affords a quick and handy way to get brass cases nicely cleaned and polished. Its vibration keeps the cases in constant motion and you can operate it without the top on, for visual check of cleaning progress.



Motion of the Lyman tumbler in operation can be seen in photo above. (Below) The box, made of 1-inch board, has a hardware cloth screen over the bottom. Put in a paper bag, cases and medium are dumped in for speedy separation of the cases.



While we're on the topic, after polishing, the cases may come out of the machine with a thin film of dust adhering to them. You may feel you'd like to get rid of that. Once, I got the bright idea of retumbling them with some of the little plastic tapioca pellets sold for refilling beanbag chairs. As it turned out, that was about the second-worst idea of a lifetime to date. To save you asking, the first-worst was the time I decided to melt some bleu cheese in with some pork and beans I was heating in a frying pan...

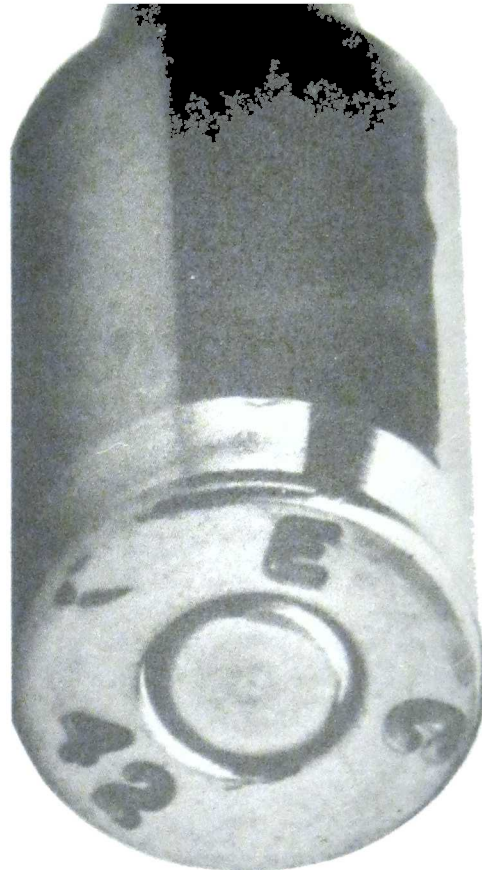


Don Krout's homemade tumbler used one coffee can for cleaning and a second for separating the processed brass from the medium, as discussed.

The beans smelled nauseating, and tasted worse. The cases tumbled in the plastic tapioca built up static electricity that made the tiny pellets cling tenaciously to everything in sight, including the cases. Each case had to be emptied, one pellet at a time, with a pair of tweezers.

If no one cares to manufacture K-Spinners for sale to the public, there is no such reluctance in the matter of case polishers or case tumblers. In fact, given decent shop facilities and reasonable ingenuity, it is possible to make up a pretty good case polisher from scratch, powered by a small electric motor. Store-bought models include the Thumler and Lyman machines, among a number of others.

The Thumler tumbler is gasketed and liquid-proof, being initially designed for polishing rocks; a process usually performed in the wet. The Lyman unit is novel in that it is a vertical tub, available in two sizes, operational without the cover in place. Installing the cover lets it run a bit more quietly. Leaving the cover off enables you to pick out a case from time to time to see how the polishing is progressing.



No, this isn't a "caliber .42" cartridge. It's a military .45 ACP, made in 1942.

It may seem like a good idea to deprime the cases first, so as to give the polishing media a chance to scour the goop and crud out of the primer pockets. In point of actual fact, you won't remove much that way and you are apt to find a granule of media solidly wedged into the flash hole, every now and again. If each case is not visually inspected and the blockage dislodged, it is quite apt to cause a misfire.

If, on the other hand, you clean, polish and then deprime, the decapping pin is going to do a positive job of making certain no blockage remains in the flash hole.

A box of some sort, with coarse screen of the sort commonly called hardware cloth fastened across the bottom, makes a super-handy device for separating the polished cases from the polishing media. The illustrated homemade tumbler, designed and built by Don Krout, of Fullerton, California, incorporates a separate device for that chore. It's a one-pound coffee can, bolted inside a three-pound coffee can, centered, with screened holes around the perimeter of the small can. The usual plastic lids go on both cans and, after a short session on the tumbler, all of the media is separated from the cases quite neatly.



When these are tumbled after being deprimed, granules of polishing medium are quite apt to lodge in flash holes, as we see in the photo above. A small pin punch pokes them out, as below.



The various makers of tumblers and polishers offer media for use in them. All of it seems to work quite well, but will wear out with extended use. The ground walnut shells offered by Thumler can be regenerated several times by adding a solution of jeweler's rouge in a liquid vehicle — also available from Thumler — to pretty good effect.

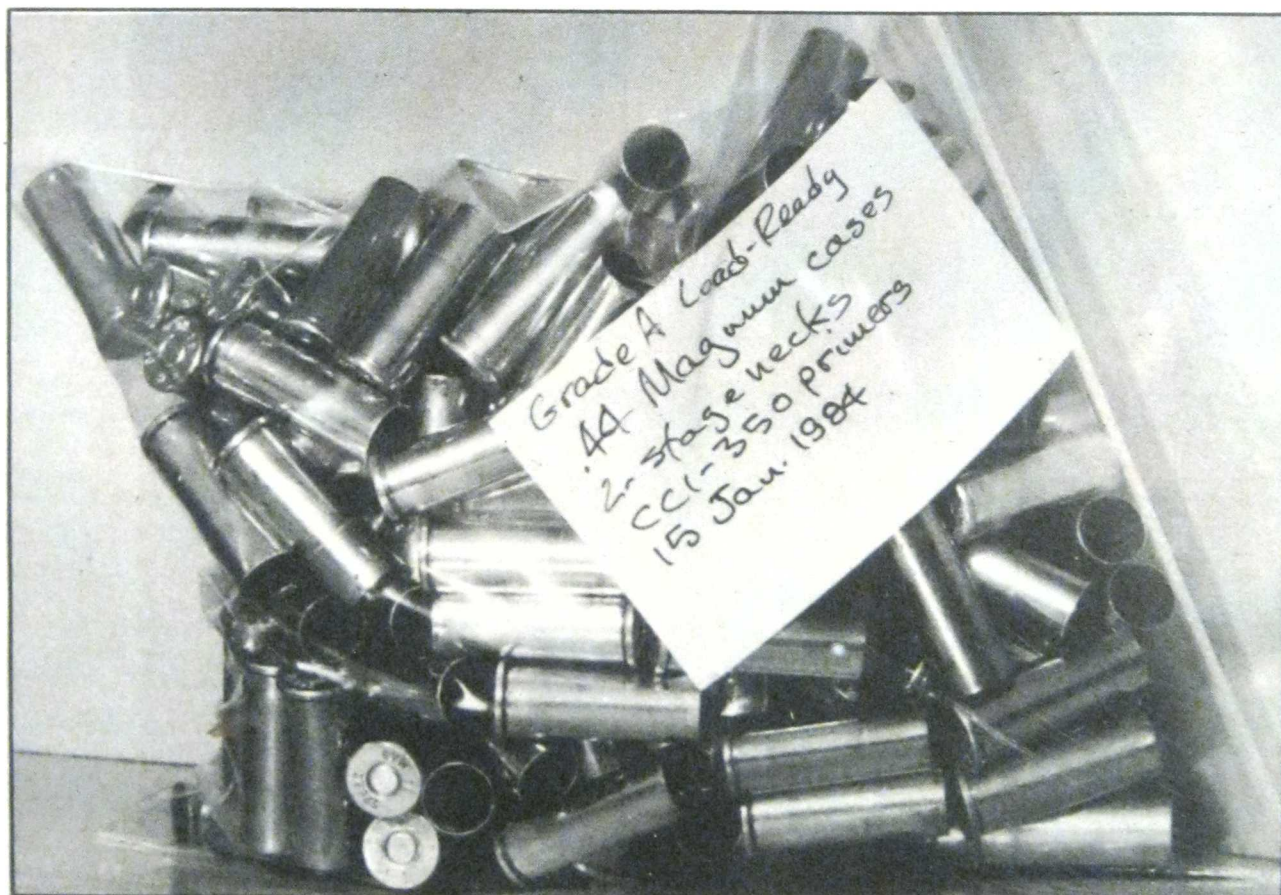
Once again, that may trigger what seems like a bright idea. Why not just grate up part of a cake of jeweler's rouge, which is reasonably inexpensive and readily available? The theory being that you add it to the tired media to rejuvenate the stuff. You might assume it would grind-down in use and deposit itself on the granules of the compound. Or you might suppose a few squirts of a solvent such as lighter fluid would help to speed the process along. I've tried it both ways, having no success with either. Adding the solvent tends to deposit the rouge in small, stubborn flecks over the case surface and nothing short of some fine steel wool and the K-Spinner will get them off.

There are more or less acceptable substitutes for polishing media. One of the better examples I've tried is the sawdust from cutting up particle board. I'll hastily note that requires a saw blade having teeth tipped with tungsten carbide, unless you want to use up a *lot* of saw blades! It works fast, produces a good shine, but usually leaves a thin coat-

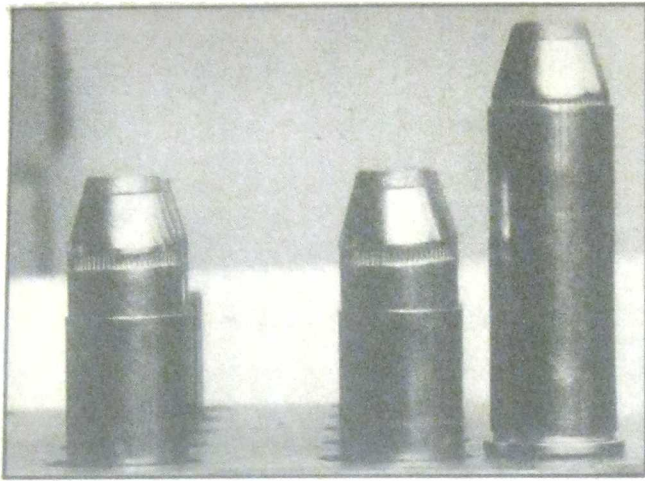
ing of dust that is probably rather abrasive. That can be removed by a second brief tumbling in sawdust from some non-oily hardwood. Walnut works well, with teak as your least-preferred choice. Teak is intensely oily, as you soon discover when you try to sand it and, in growing, it picks up inclusions of silicates that will throw sparks when it's being cut. Always use carbide-tipped blades when cutting teak.

Tacking back to the primary topic...we've got the cases retrieved, sorted and cleaned. If you are going to proceed with reloading them, it only remains to trim the bottleneck cases, as discussed earlier and perform the other operations.

If you don't wish to reload them at once, you have at least two other options. You can restore them to load-ready status by going through all the steps except dispensing the powder charge and seating the bullet. That saves a lot of useful time when you get to the point of reloading them next time. A good procedure is to store the cases in the small (one-quart size) Zip-Loc Baggies, sealed at the top, with an identifying small card or slip of paper giving such details as you think may be useful. Definitely, that should include the make/type of primer seated in the cases.



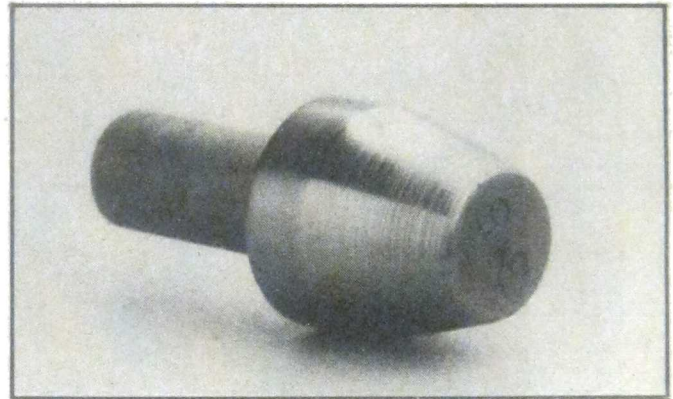
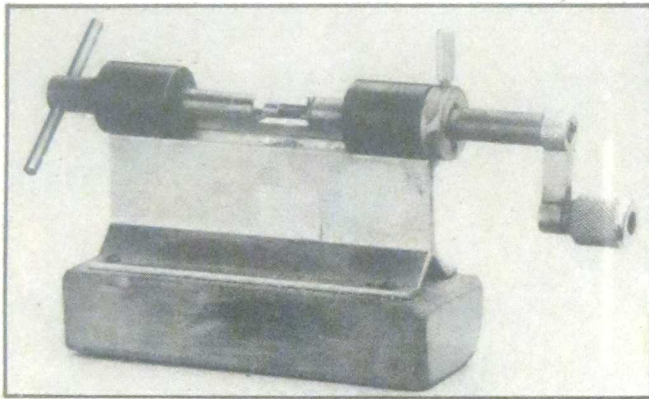
A Baggie full of load-ready cases can save a lot of time on some harried future occasion. To explain the mysterious "two-stage necks:" I've two carbide sizing dies in .44 mag; one a bit tighter than the other. The first one deprimers and resizes full-length. The tighter die is adjusted to squeeze down only about the top 1/4-inch or so of the case neck for a better grip of the bullet base. Note that the make and type of primer is also identified.



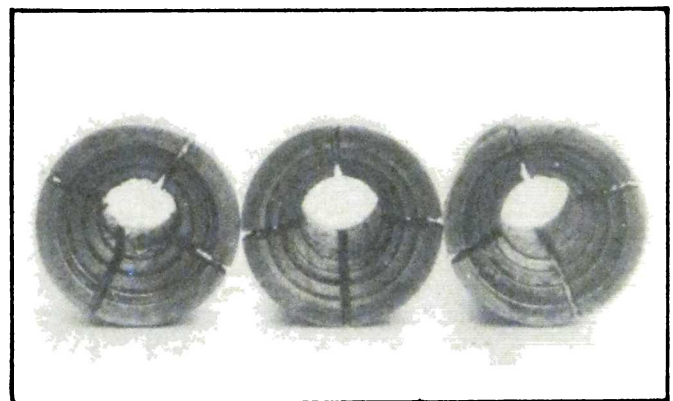
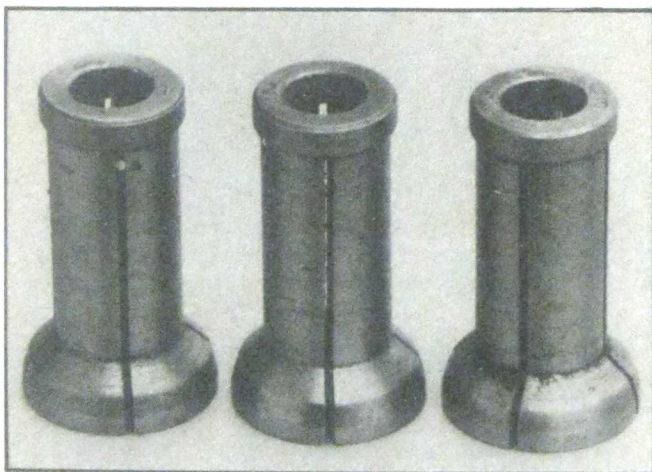
Lyman M-Die expander flares the mouth gently as in the .44 mags, enabling starting of the bullet base into the neck, though hardly visible.

Even if you don't bring them to load-ready status, the Baggies still make an excellent storage approach. They protect the cases from random shop dust and the attentions of homemaking spiders and the like. Unlike storage in old coffee cans, the nature of the contents is pretty obvious at first look. Coffee cans, if used, should be labeled clearly. The little self-adhesive labels, available from office supply stores, lettered with felt-tipped pens, work well for that.

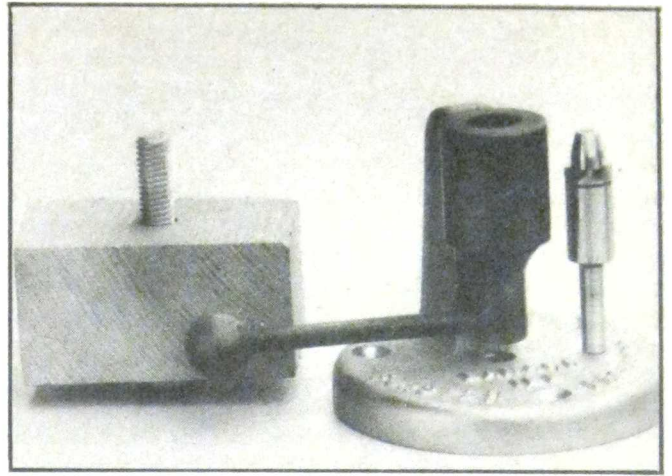
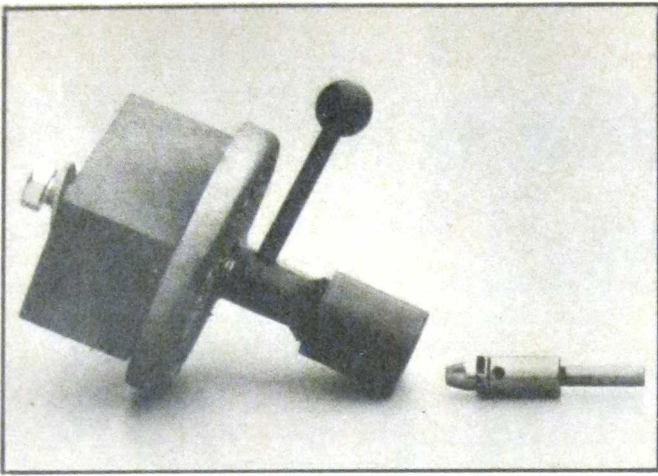
The usual routine trimming of cases that are to be reloaded for use in the same gun is handled nicely by hand-cranked case trimmers. Now and again, you may find it necessary to remove a substantial amount of metal from the mouth. Examples include making .30 or .357 Herrett cases from .30-30 WCF parent brass or perhaps trimming some .44 magnum cases down to create .44 Special cases. Extreme examples include making .451 Detonics magnum or .41 Avenger cases, starting from the .308 Winchester or .30/06 Springfield cases.



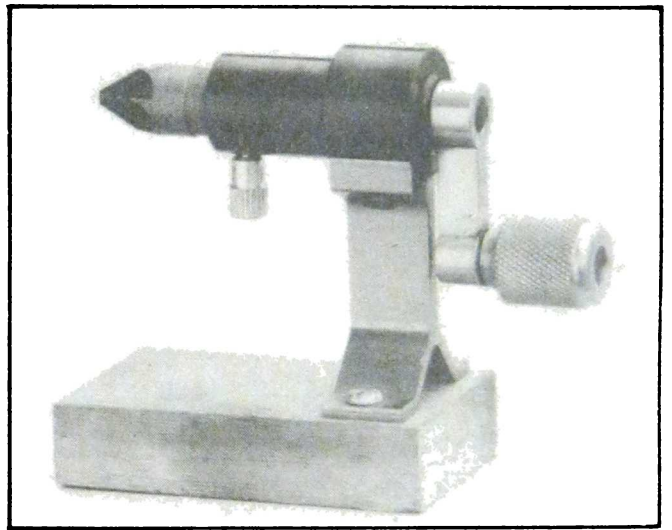
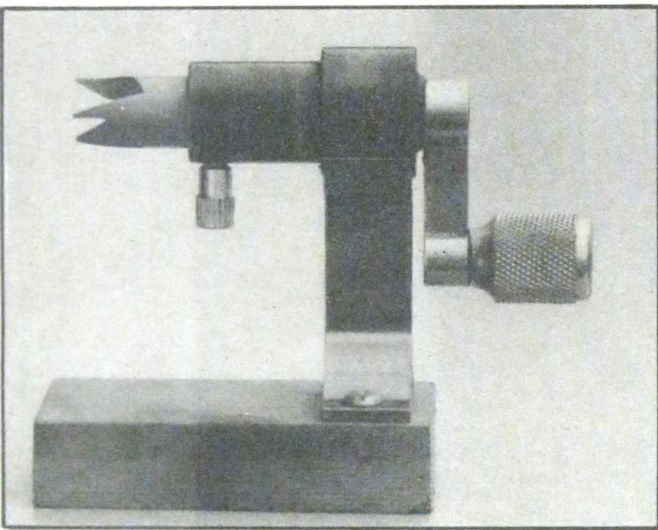
The hard-working Forster trimmer is mounted to a block of scrap hard maple for installation in the bench vise during routine use. Trimming requires a pilot plug, such as .35 size at right.



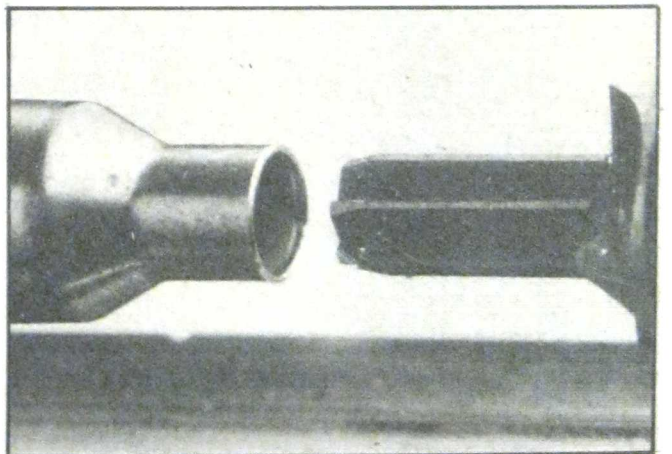
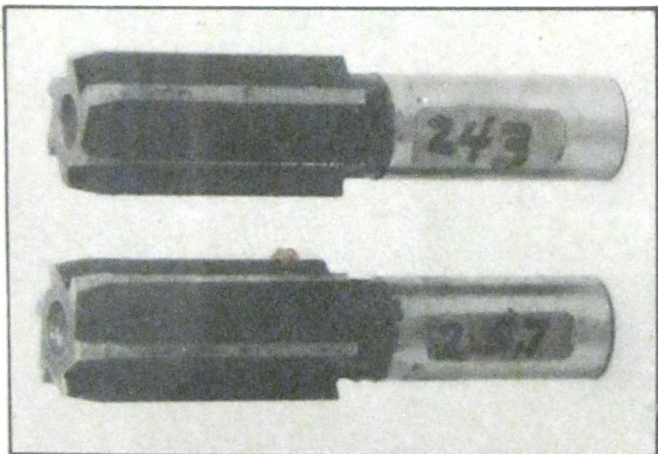
Side and end views of the three collets that enable the Forster trimmer to handle all or nearly all cartridge cases. Handle at left of the trimmer is tightened to grip case head with proper collet.



Two views of Forster's kit for trimming cases on a drill press. Block of wood and $\frac{3}{8}$ -16 bolt are not supplied, but are used to secure the base to the drill press table from underneath, in alignment.



Forster's handy holder for the inside/outside case neck deburring tool, shown in both modes. The holding screw is homemade to replace the hex-socket screw customarily supplied.



Two of the Forster case neck reamers, in .243 and .257, with another view of the technique for using them, as on opposite page, to throat-out a .22-250 Rem case neck.

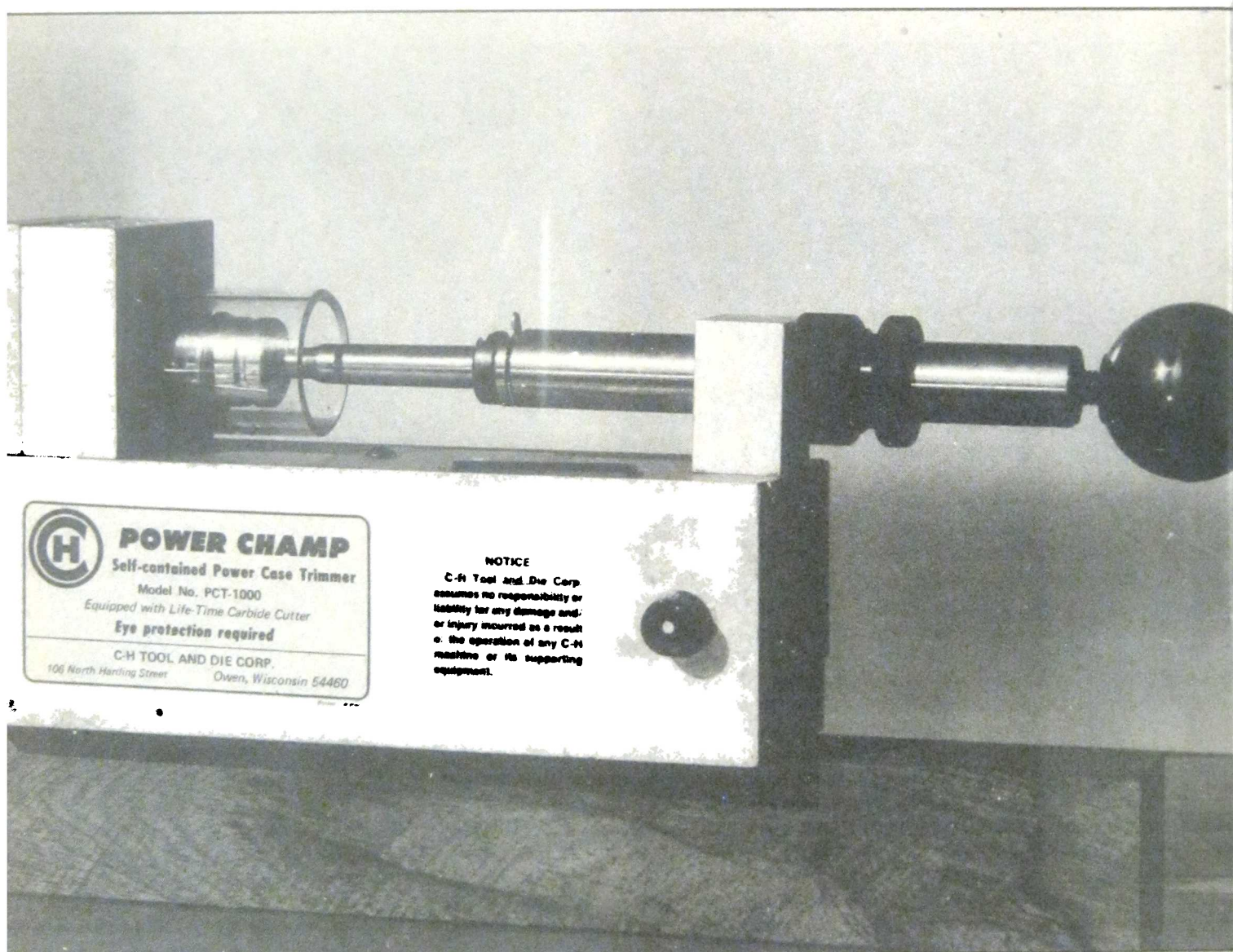
That is when power-trimming can save a lot of time and vast amounts of elbow-grease. At a price of \$175 or so, the C-H power trimmer may or may not be practical, depending upon the quantity of cases you're contemplating. At less cost, there is the power-trimming kit from Forster Brothers that attaches to a drill press. If you need to circumcise a lot of brass from a lot of cases, the Forster rig has no equals of which I'm aware. It takes a bit of patient care and fiddling to get it set up and adjusted but, after that, you can whittle them down in wholesale quantities in fine style.

Even the doughty Forster power system comes down stymied when you get to chopping the front two-thirds or three-quarters off of bottleneck rifle cases, as in the exam-

ple of making .45 D-mags from .308 Winchesters and the like. The caliber .30 pilot will guide it through taking off the neck and it's not much help after that.

The last time I grappled with that particular problem, I crafted up a small holder from hardwood that would grasp the rifle case snugly. I installed a metal-cutting blade on the table saw and used the rip fence to guide the cutoff. I hasten to say I wore a sturdy plastic face mask while thus engaged. Even a large pair of shooting glasses is insufficient eye protection when cutting metal on a table saw!

I set it to get within perhaps .125-inch or so of the desired final length and took the rest of it off by truing-up the burred case mouths in the lathe and then using the Forster power trimmer for the final cut, returning to the lathe for inside



C-H Tool & Die Corp. offers their C-H Power CHamp self-contained power case trimmer with lifetime carbide cutter. It holds cases by means of the regular shell holders.

reaming of the case mouths. Candidly, it is hard, tedious work and I think it's a preferred shortcut to just send to Detonics for a quantity of unprimed .451 D-mag cases.

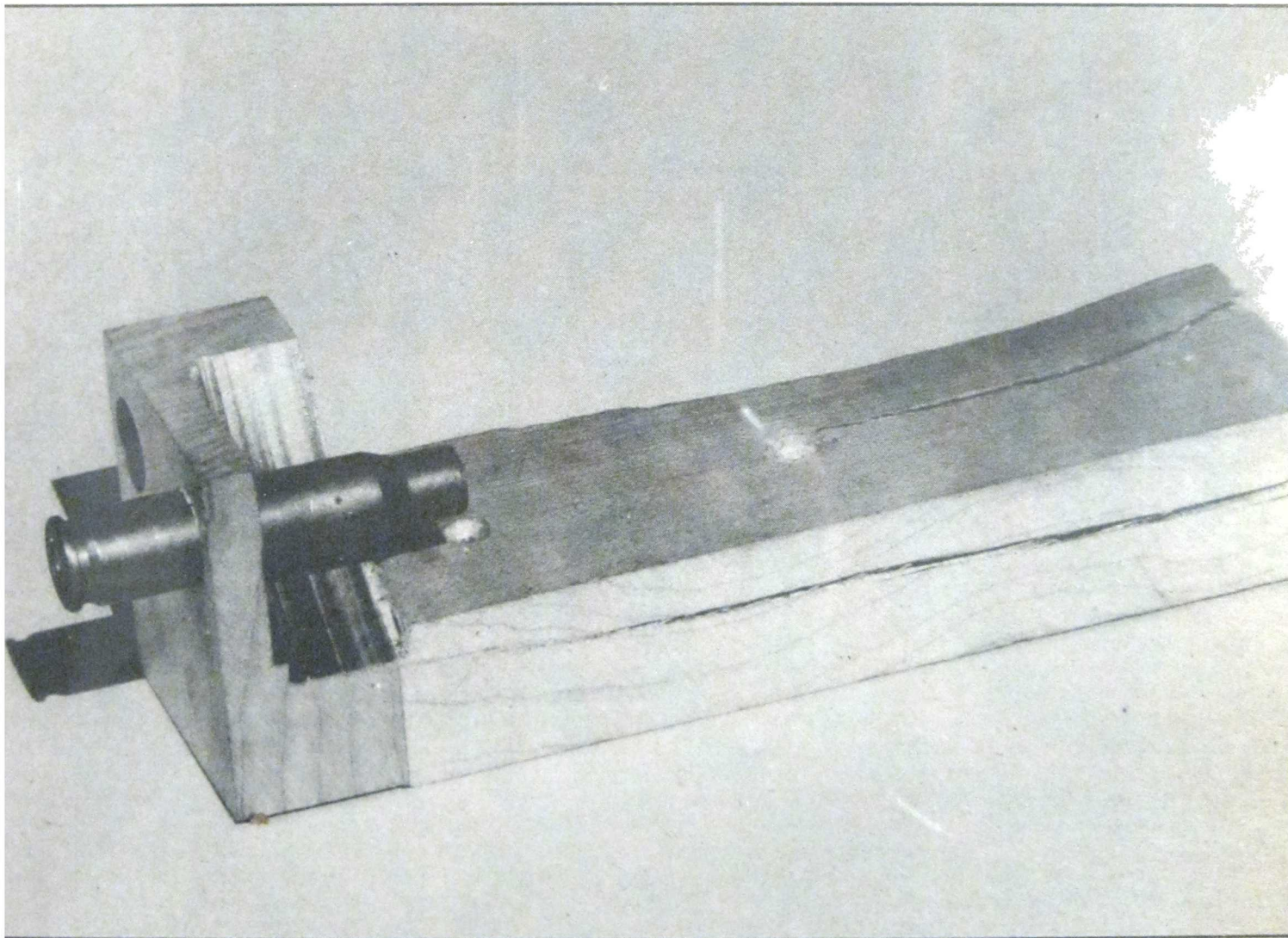
There are times when you can save money by working and there are other times when you can save work by disbursing a spot of funds. Skilled play consists of being able to decide which way to go in a given set of circumstances.

It is possible to create a great many wildcat or scarce cartridge cases by more or less simple conversion of cases that are in more plentiful supply. Some examples involve nothing more than a pass of the parent case (suitably lubricated!) up into the resizing die of the loading set for the new cartridge. One such example is the .411 JDJ, an arresting concept from the intrepid J.D. Jones, which I

might've christened the .41 Jeroboam or perhaps Nebuchadnezzar — those being the champagne bottles larger than the humble magnum. The .411 JDJ is, quite simply, a .444 Marlin case necked down to hold a .41 (.410-inch diameter) bullet securely.

Some wildcats are created by fireforming the parent cartridge in the given chamber, an example being the .22 K-Hornet, as invented by the late Lysle Kilbourn. Simply put a .22 Hornet reload or factory load in a gun for the K-Hornet, fire it and extract your K-Hornet case for further use. If the case has been reloaded several times in its original Hornet format, the shoulders may fail in fireforming. The remedy is to anneal the case necks.

That is accomplished by standing the cases (deprimed,



Made up from hard maple scrap wood, this is a holder for trimming off the front ends of .308 Win. cases on a table saw, using a metal-cutting blade and face mask to protect against the hurtling metal particles. It's positioned by miter guide and zeroed on rip fence.



The .223 Rem/5.56mm case second from left serves as parent brass for these three wildcats. Number 1 is a 7mm T/CU after fireforming; #3 is a 7mm T/CU on its first loading, before fireforming; and #4 is the 6.5mm T/CU with .264 bullet instead of .284-inch diameter.

If you like the .41 magnum (right), you'll just love the .411 JDJ (left), which launches the same diameter of bullets out of a lightly necked .444 Marlin case. SSK Industries, Rte. 1, Della Dr., Bloomingdale, OH 43810, supplies barrels for this remarkable cartridge for use in the Thompson/Center Contender receivers.

or with dead primers!) mouth-up in a tray containing about one-half inch of water. Apply the flame of a propane torch to each case mouth in turn until it barely begins to glow with a visible reddish radiance, then tip that entire case over into the water. Do the same to each case in turn. Dry the cases thoroughly before continuing with the reloading operations.

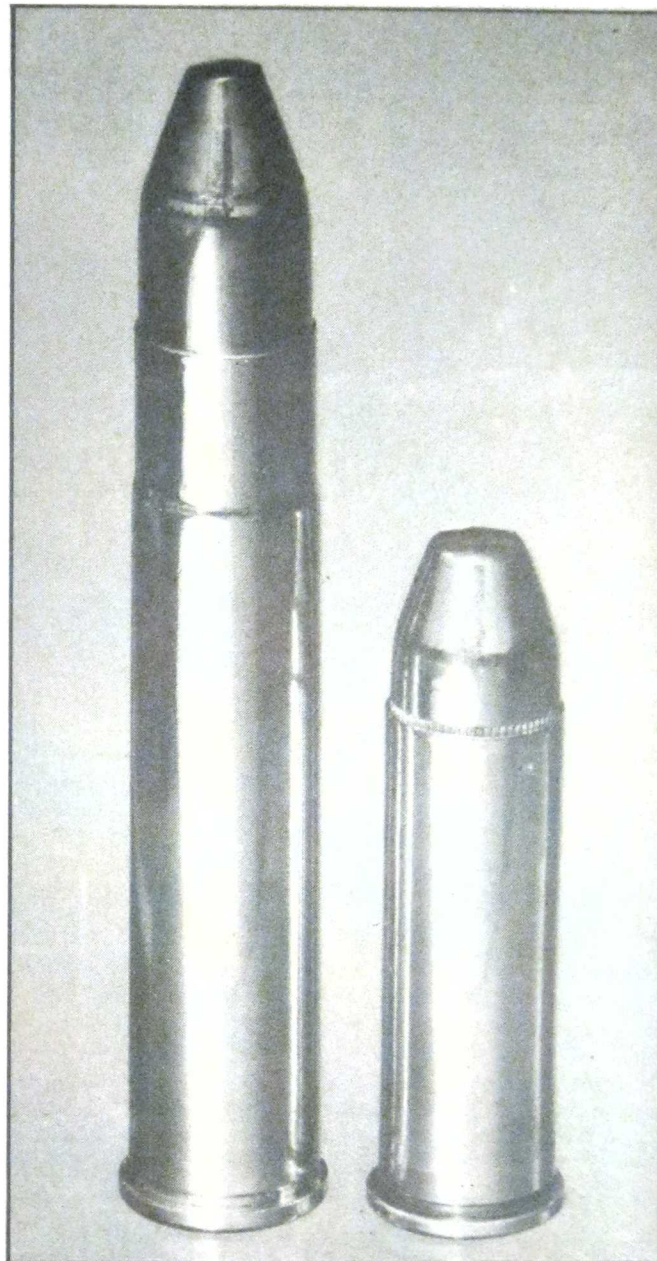
The purpose of the water is to avoid annealing the case at the head. That's the last thing you want, a case that's soft in the head! A soft-headed case will expand at the head, even under routine pressures, enlarging the primer pocket and, quite possibly, releasing high-pressure powder gas into the action.

Other wildcat cases, such as the entirely admirable 7mm T/CU (Thompson/Center Ugalde), are made by expanding the mouth of the parent case — the .223 Remington, in this example — to larger-than-wanted diameter, then necking it back down to the diameter you had in mind. The first firing after that at moderate pressures takes care of fitting it nicely to the chamber. In such examples, the fireforming load should be considerably less vigorous than the usual loads listed in the manuals.

It was mentioned before but I think it bears noting again: Faced with a shortage of — for example — 8x57mm Mauser cases, you can make them up from .30/06 brass without undue complications. The pitfall lurks in the fact the headstamp will still proclaim the cartridge to be a .30/06 (assuming you started with commercial brass). An 8mm Mauser, being somewhat shorter, will chamber in a .30/06 rifle but, if fired, about the time its .323-inch bullet encounters that .308-inch bore, all hell is out for noon.

Once, all unwittingly, I pulled a booboo nearly that bad and, thanks to an Irish guardian angel I call Mister Mulligan, got away with it. I spotted an unmodified military rifle in a pawn shop, priced so attractively I couldn't resist giving it a good home. It was tagged as a 7mm Mauser, or 7x57mm Mauser, as we usually say. At the time, the office facilities included a sturdy homemade bullet trap sited in front of a brick wall a full foot in thickness and the isolation in the late evening was such that no one came unglued at the sound of a muffled gunshot. I used to do a lot of constructive ballistivating there in those days and wish to heck I had comparable arrangements these latter days.

The ammo shelves produced some 7mm Mauser factory load and I put one in, fired it, chambered a second and fired that for good measure. As I worked the bolt back, my eye caught the spent case flipping from the chamber and some-

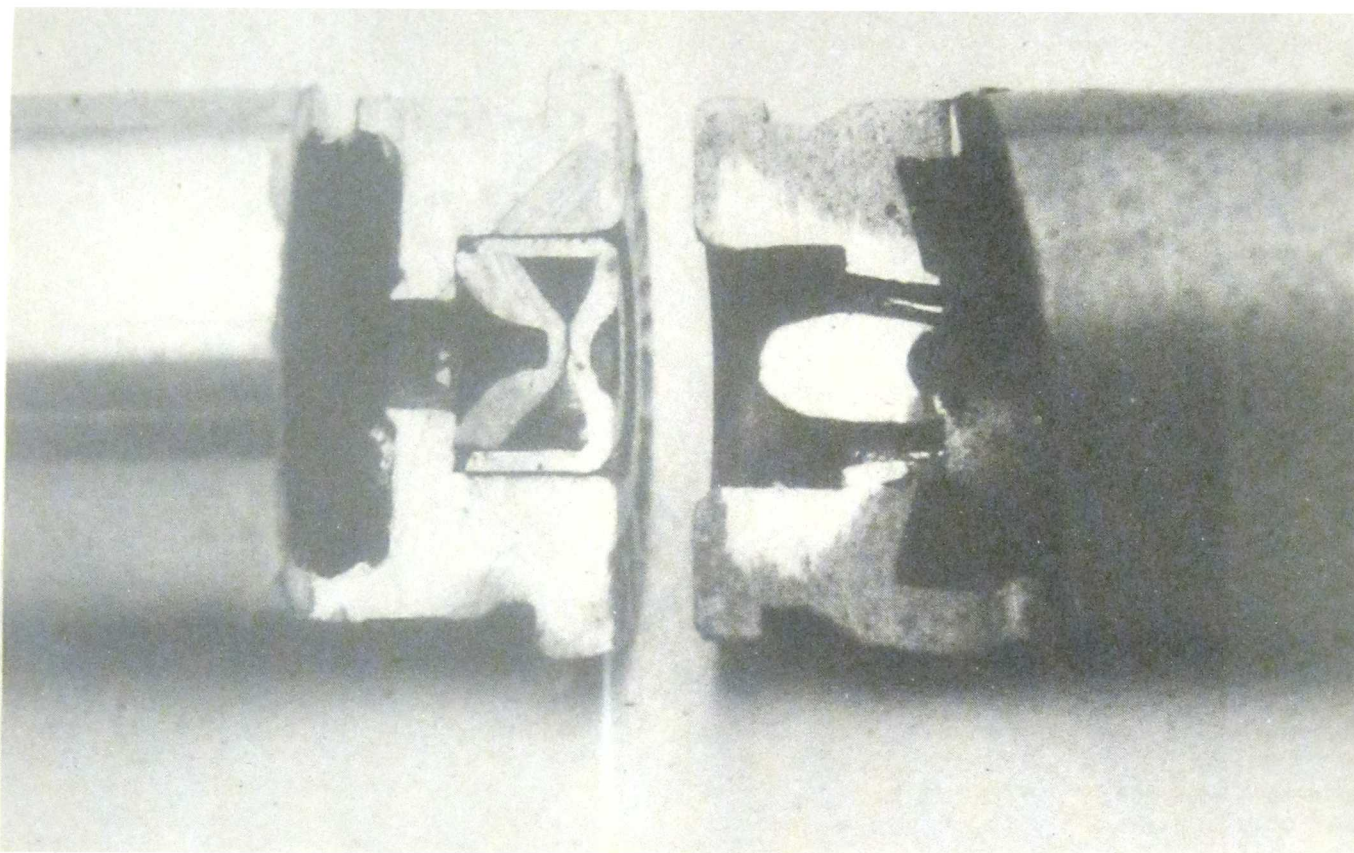


thing looked odd. I retrieved it from the floor. Odd? Hardly the word for it!

The case shoulder had been moved forward a substantial distance and had been opened up with scalloped vents that reminded me of the sort of collar Sir Walter Raleigh used to sport. Scenting an overripe rodent, I made the exhaustive measurements and examinations that'd've been a good idea on first receiving the rifle. As it turned out, someone had rebarreled it to .270 Winchester. In firing the supposed rightful cartridge, I had been swaging .284-inch bullets down to .277-inch bullets in an incredibly brief span of time.

It was an experience of the indelibly educational sort and my chief regret was that I couldn't provide Mister Mulligan with a deep snort of Tullamore Dew to demonstrate my gratitude.

NOTES ON PRIMERS



The Boxer-primed .38 Special case at left and the Berdan-primed 9mm Luger case at right have been sectioned to illustrate the basic differences between the two priming systems. The Boxer primer has been fired (fortunately!) and you can see how the tip of the firing pin dented the cup to crush the wafer of priming compound against the anvil. Note the twin flash holes of the Berdan case and its fixed anvil.

The “Reloader’s Spark Plug” Plays A Vital Role And Here Are Thoughts On Selection And Seating, As Well As Problems And How To Avoid Them.

CENTER-FIRE PRIMERS take two basic forms: the Boxer type and the Berdan type. We are primarily concerned here with the Boxer type, since virtually all reloading is geared to handle that one.

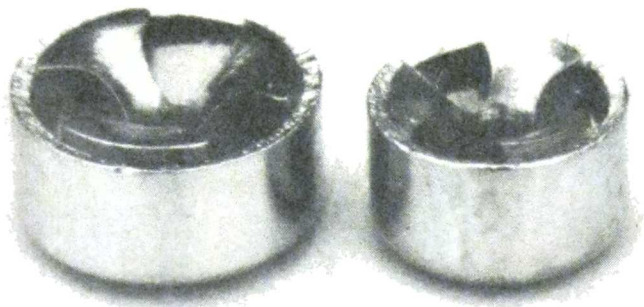
A cartridge case intended for use with Boxer primers will have a primer pocket leading to a single central flash hole that directs the hot gas from the priming compound up into the powder charge inside the cartridge case.

Boxer primers, with few if any exceptions, come in two diameters: .175-inch (small) and .210-inch (large). Both diameters are supplied as pistol type and rifle type. That gives us four basic formats for use in metallic (i.e., handgun and rifle) cartridges. Some makers of primers, such as Omark/CCI, offer all four in a choice of either standard or

magnum, raising the number of choices to eight. Other makers list some though usually not all of their primers in magnum as well as standard versions.

Quite a few years ago, primers of that era used to come in two shapes: flat and rounded, or domed. That referred to the contour or profile of the portion of the primer cup exposed after priming. It was more or less necessary to maintain two priming punches in each size, so as to seat the rounded primers without undue distortion. At some happy point along the way, primer manufacturers agreed to standardize upon the flat shape of the primer cup, thus simplifying the situation in a most helpful manner. It is rather unlikely that you will encounter any primers with domed cups in these latter days.

The typical Boxer primer is illustrated by an accom-



The two common sizes of Boxer primers are the large .210-inch at left here and the small .175-inch at right. Note the slight amount of protrusion of the anvil legs.

panying cross-sectional line drawing that shows its basic and fairly simple construction. It consists of a cup, drawn to shape from an alloy of copper, usually though not always nickel-plated, with a wafer of priming compound lying immediately next to the inner face of the cup. A layer of waterproofing foil goes over that and an anvil is seated in the front of the cup with a snug friction fit. The anvil usually has three legs, sometimes two, and the tips of the legs can be seen to protrude slightly past the rim of the cup. That enables the anvil to prestress the wafer of priming compound when the primer is seated.

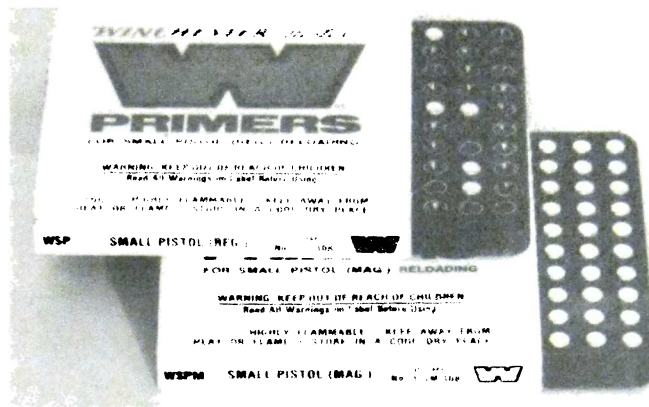
The priming compound usually contains a chemical called *lead styphnate* as its active ingredient, along with certain other additives to improve or modify its performance. The original priming compound was fulminate of mercury, or *mercuric fulminate*, which performed reliably enough, but it had undersirable side effects when used with brass cartridge cases: The residue left after firing contained small amounts of mercury which would form an *amalgam* or physical combination with the brass, crystallizing and weakening it.

That led to the introduction of a non-mercuric priming compound which included some amount of *potassium chlorate* ($KClO_3$), a powerful oxidizing agent. During the chemical reaction of combustion, a residue would be deposited inside the cartridge case and gun barrel, containing potassium chloride, a compound quite similar to common table salt (sodium chloride) in that both are *hygroscopic*. That means they extract moisture from the atmosphere to generate rust on iron or steel. With the chlorate or corrosive primers, prompt cleaning of the bore after firing was absolutely mandatory and, if neglected, the barrel would be ruined.

The after-firing residues left by the lead styphnate priming compounds are much less corrosive than those of the chlorate primers. That does not necessarily imply the bore never needs to be cleaned, but it mutes down the level of panic quite usefully.

Mercuric primers fairly well left the scene a long time ago. By the time I was a tousle-headed farm lad buying .22 rimfire ammo in the mid-Thirties (.22 shorts were eighteen cents a box and no sales tax...). Remington's Kleenbore load was already much in evidence; one of the earlier non-corrosive loads.

Corrosive primers continued in use for most military ammo through WWII and for a time after that. Desirable though the



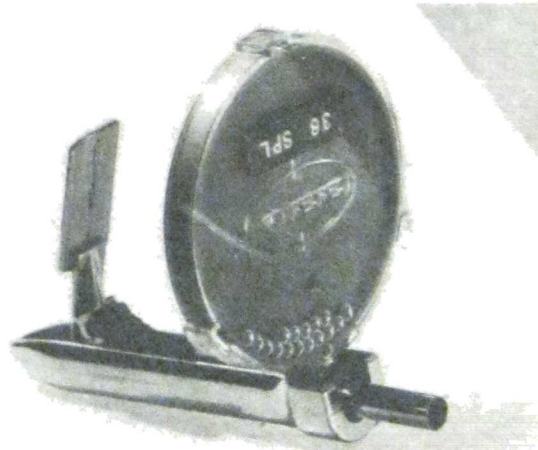
Winchester designates their small pistol primer as #1½-108 for the standard and #1½M-108 for the magnum type, the lower of the two boxes shown.

non-corrosive types might seem to a civilian firing them in his own gun, the military mind — legendarily reluctant to change — held that the chlorate or corrosive primer was slightly more reliable. Whether it is or not is a highly debatable point. As for the danger of corroding the bore, well, heck, let the men clean the blasted bores or face a statement of charges for repair or replacement of the piece!

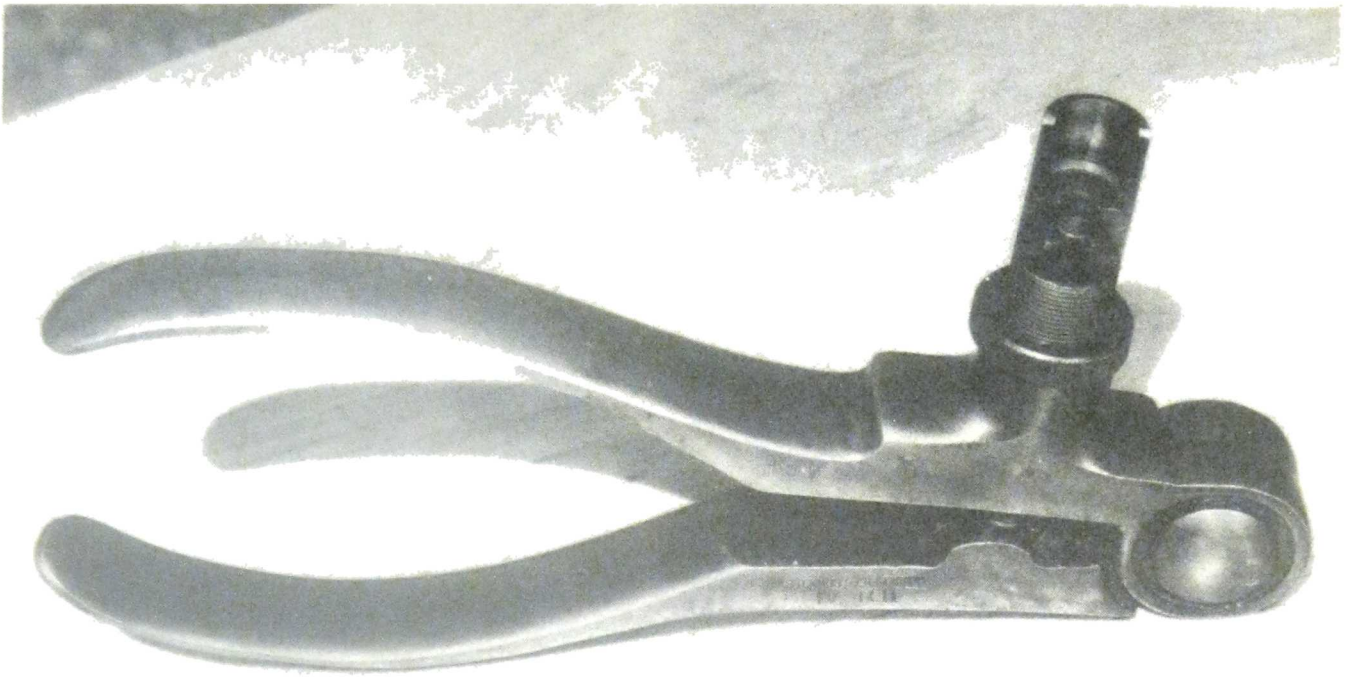
The eventual transition to non-corrosive primers for military smallarms ammo took place some time *around* 1952. The exact date probably varied in accordance with when a given ordnance plant exhausted their remaining supplies of the old-fashioned, eat-the-rifling-right-out primers. Thus, the first non-corrosive production for some headstamps may be up in '53, perhaps even later. I note all that for the sake of hoarders, such as myself, who may have unfired military ammo of early vintage still on hand. If you've any doubt at all, clean promptly after firing!

In fact, it is an excellent idea to clean the bore promptly after firing the first few reloads in cases they were originally primed with the chlorate primer, on the chance that some small amount of corrosive residue may have remained inside the case through the first, second or third firing.

The corrosive-primed cartridges most apt to plague U.S. shooters and reloaders are the .30/06 Springfield, .45 ACP



Lee Precision's Auto-Prime feeds primers into place by gravity. As noted on page 283, Lee urges that primers other than CCI or Winchester be avoided.



Lyman's #310 tong tool, or "nutcracker," here with the priming attachment installed. This one's vintage of about 1951, when they were made of steel and nicely blued. The #310 and Tru-Line Jr. press both used dies having $\frac{1}{8}$ -40 thread instead of the usual $\frac{1}{8}$ -14, but adapters are available from Lyman to larger size.

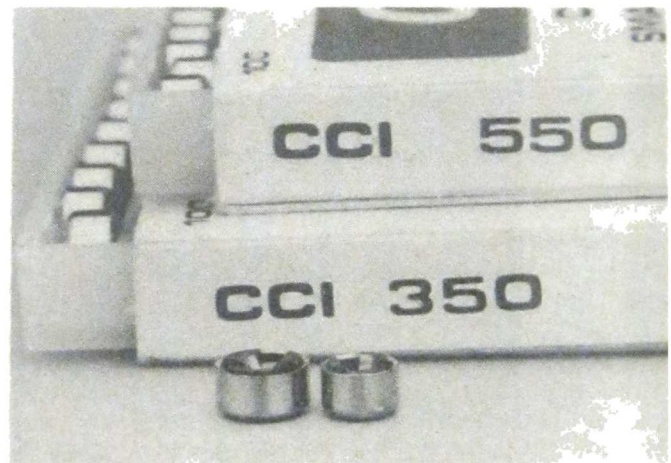
.45-70 Govt. and .30-40 Krag. The cartridge variously known as the .308 Winchester 7.62mm NATO or T-65 was adopted in 1954 and, we would dare to hope, rarely if ever has been loaded with corrosive primers. The same applies to the 5.56mm, or .223 Remington, cartridge.

As has been noted elsewhere here, the year of manufacture for a military cartridge usually can be seen on its headstamp, although the common term for the caliber is given but rarely. One fairly large batch of .45 ACP ammo bore only the headstamp of *TW* over the digit 5, presumably signifying 1945, as most of it was put up in steel cases and those were dropped quickly when the wartime shortage of copper eased off a little.

The difference between the handgun (pistol) primer and the rifle primer is that the rifle primer has a somewhat thicker and/or tougher cup and its front-to-back dimension may be slightly greater than that of the handgun primer. At the same time, the wafer of priming compound in the rifle primer may be larger and/or have greater *brisanse* (brusqueness of explosion) than that of the handgun primer.

If you attempt to seat a large rifle primer in the pocket of a .45 ACP pistol case, you may experience considerable difficulty in getting the face of the cup flush with the surrounding surface of the case head. More, the lighter force upon the firing pin of handguns often is not vigorous enough to set off rifle primers due to the thicker cups.

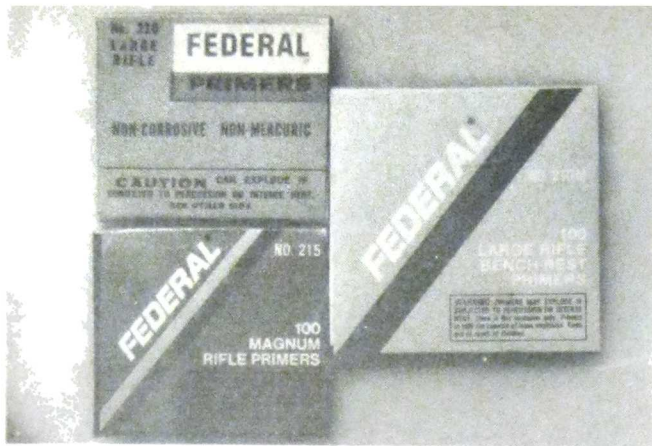
Conversely, if you put a large pistol primer in a case such as the .308 Winchester, .30/06, .22-250 Remington or the like, it tends to seat rather low in the pocket. If the powder charge approaches maximum performance for the given cartridge, there is a likely chance the primer cup may rup-



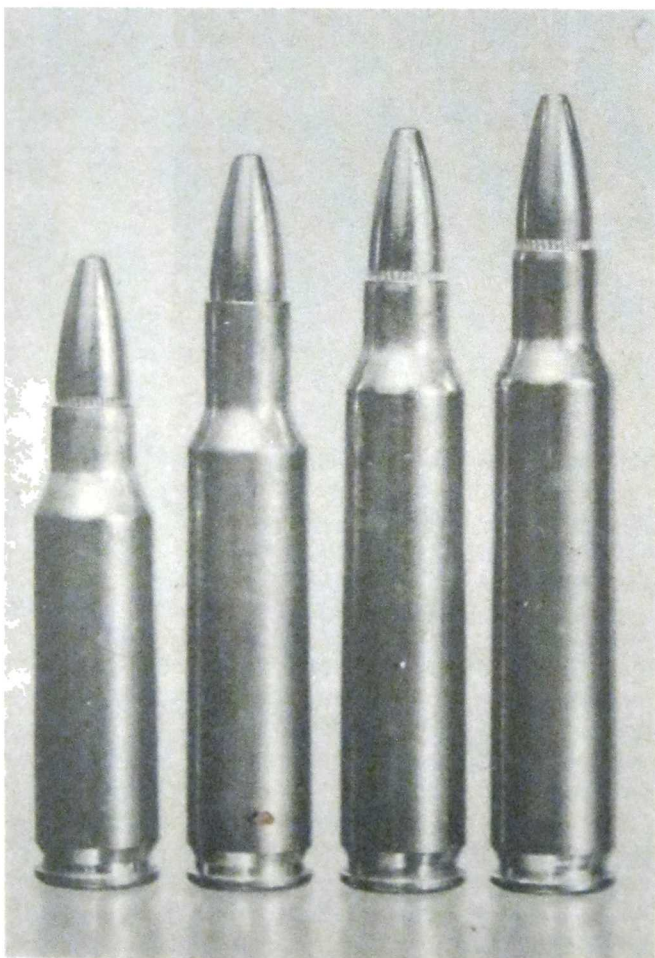
Omark/CCI designated their standard small pistol primer as 500 and standard large pistol as 300. The respective magnum versions are 550 and 350.

ture, releasing high-pressure gas into the action. Believe me, you do not want that to happen!

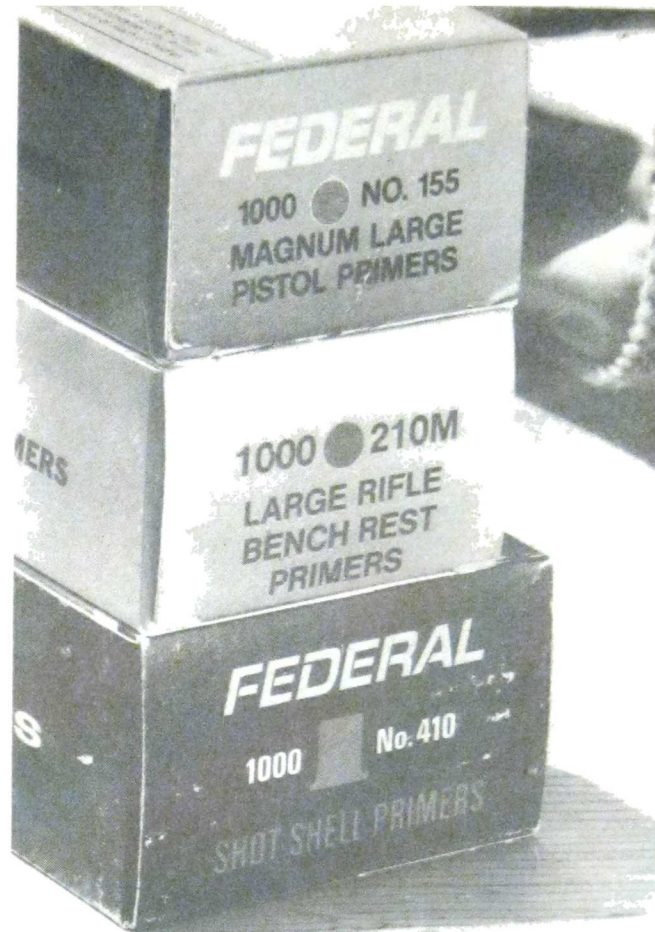
We come now to a confusing sort of gray area in the matter of choosing between a handgun or rifle primer for the cartridge being reloaded. The dividing line between handguns and rifles is by no means as clearly drawn as it used to be. The trend began in the early Sixties when Remington introduced their Model XP-100 pistol for the .221 Remington Fire Ball (sometimes spelled Fireball) cartridge. The .221 is a slightly shortened version of the .222 Remington, .223 Remington and .222 Remington magnum. The XP-100 pistol is a bolt-action, single-shot design with



Federal offers three large rifle primers: #210 standard, #210M match and #215 magnum. The match primers usually deliver better accuracy.



From left: .221 Rem Fire Ball, .222 Rem, .223 Rem and .222 Rem magnum. All require small rifle primer.



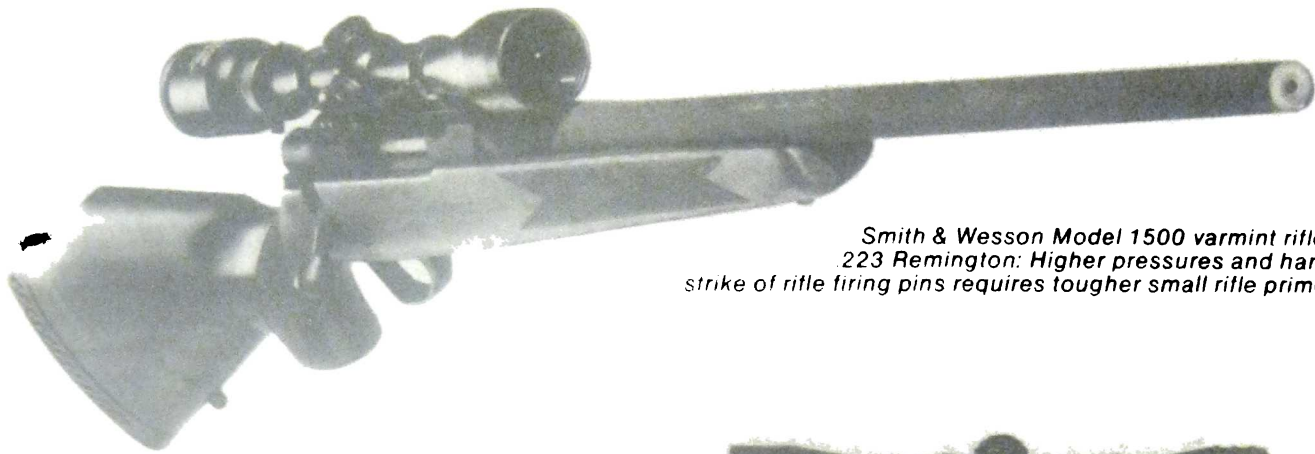
Customary packaging of primers is 100 in a flat pack and ten packs in a carton. The #410 is a shotshell primer designed for reloading the .410-bore shells and certain other uses.

more than ample force on its firing pin for setting off small rifle primers and the cartridge operates at pressures well above typical handgun cartridge levels. Accordingly, when reloading the .221 Fire Ball, you need to use small rifle primers, even if the pistol is held in one hand for firing.

The gathering trend accelerated further in 1967 when Thompson/Center Arms brought out their Contender single-shot pistol featuring interchangeable barrels. Barrels could be had in anything from .22 LR rimfire up through some pretty potent rifle cartridges, such as the .30-30 WCF (Winchester Center-Fire). The Contender action is uncommonly strong for a handgun, but by no means utterly indestructible.

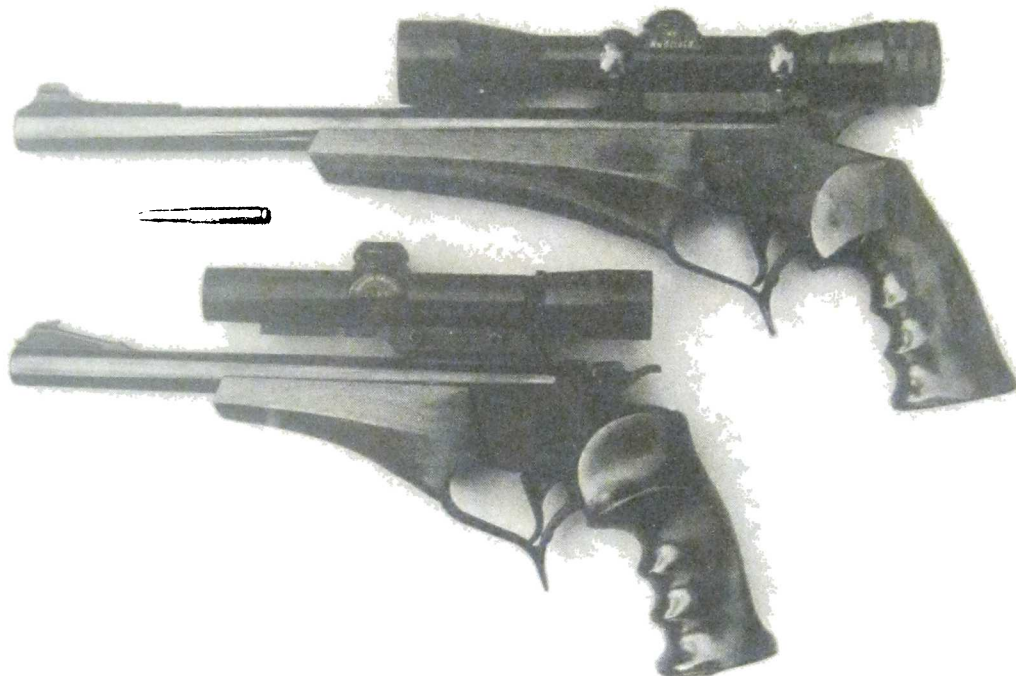
Accordingly, the general rule of thumb for choosing between handgun or rifle primers depends more upon the nature of the cartridge case than upon whether the gun that fires it is held in one hand or against the shoulder. The .22 Hornet is an excellent performer in the Contender, one of the best available, but the Hornet case is a rifle case and you use small rifle primers when reloading it, even for use in the Contender. You use large rifle primers when reloading the .30-30 WCF, following the same basic philosophy, and so on. The blow of the Contender hammer is quite amply strong enough to set off the tougher rifle primers of either size.

Although the .357 Remington Maximum cartridge is an



Smith & Wesson Model 1500 varmint rifle in .223 Remington: Higher pressures and harder strike of rifle firing pins requires tougher small rifle primers.

Advent of the T/C Contender in 1967 with barrels to handle high-power rounds such as the 7mm T/CU, made it necessary to use small rifle primers in handgun reloads.



elongated version of the .357 magnum, I usually use small rifle primers when reloading it and, of those, usually choose the Remington #7½ type because I've found it to have about the toughest cup of all the small rifle primers available. The small rifle primers seat in the .357 R-max pockets with no difficulty as to excessive protrusion.

The magnum-type primers are supposed to deliver a longer blast of powder gas and incandescent particles than do the standard types. That is said to provide superior reliability and uniformity of ignition when the powder is slow-burning, difficult to ignite, or both. More, the magnum primers are claimed to perform better when used at temperatures at the low end of the thermometer scale.

The reluctant powders are taken to include most if not all of the Ball Powders® from Olin/Winchester and the Spherical® propellants marketed by Hodgdon Powder Company. The slower tubular or extruded powders such as the various versions of 4831 likewise are said to benefit from magnum primers.

At various times, I've tried making up loads identical except for use of both standard and magnum primers, going on to chronograph the resulting velocities and perhaps to

compare the groups' sizes obtained with each. It has been rare to discern much by way of clear-cut differences and, sometimes, the standard-primed loads will show slightly higher velocities. Nor is there a great deal of difference in tightness of the groups for one over the other.

As a general observation, I use standard primers if they seem to function in an acceptable manner and that's true most if not all of the time. Some writers have voiced solemn warning against the use of magnum primers under any condition. I do not go along with that.

Candidly, I've had little occasion to fire any gun at extremely cold temperatures since leaving Wisconsin in 1966 and have no complaints about that whatsoever. For those who remain in cold country, sufficiently intrepid to venture forth on days when the mercury huddles at the bottom of the tube, the magnum primers may offer worthwhile advantages.

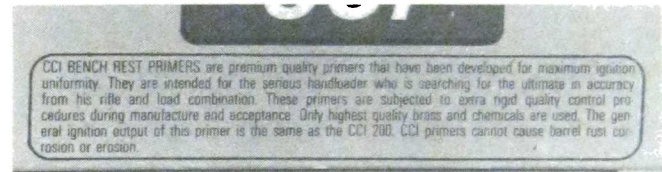
A still-further variation is the benchrest primer such as the Federal #210M large rifle or the CCI #BR-4 (small rifle) and #BR-2 (large rifle). A minor source of confusion is the designation of the Federal primer, as some take it to mean magnum. The Federal Large Rifle magnum primer is



Left: For the past many years, .38 Special cases have been manufactured for use with the small pistol primers, but a few old cases such as the one at left here, carry pockets for the large pistol size. (Right) Remington's #7½ small rifle benchrest primers have super-tough cups of unplated copper alloy. Cartridge is .357 R-Max.



CCI's BR-2 and BR-4 are benchrest primers for large and small rifle, respectively. Their force is the same as standard primers, as noted at right.



Label on CCI BR-2 carton gives particulars.



CCI's benchrest primers are stamped with a small letter B on the face of the cup, making them one of the very few primers that are visually identifiable.

designated as #215 and the M in #210M stands for match.

The CCI Benchrest primers are stamped with a tiny letter B, slightly off-center of the exposed portion of the primer cup, making them readily identifiable under close examination. About the only other primer that can be identified visually is the #7½ Remington with its cup left in natural copper color.

I contemplated inclusion of a chart giving specifications of the various makes and types of primers, but was somewhat reluctant to do so. For one thing, I didn't want to include the color of the foil because that can change with age, white to yellow and so on. I did not wish to seem to imply that it's possible, safe or practical to attempt to identify an isolated primer or group of primers solely by their appearance.

At the bottom line, the best way to keep track of the make/type of a primer is to leave it in its original labeled container until you're ready to use it.

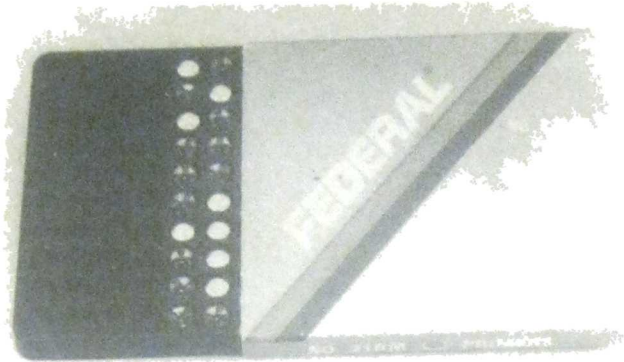
PRIMER MALFUNCTIONS

A primer may sometimes fail to fire at the first strike of

the firing pin. It may fire on the second strike or it may adamantly refuse to fire, no matter how many times you try. Such problems can occur with factory loads, as well as with reloads.

A major contributing cause is deactivation of the wafer of priming compound through exposure to oil. WD-40 is a compound of petroleum distillates, usually furnished in spray dispensers. The label says it stops squeaks, frees rusted or sticking parts and protects all metals, displacing moisture. It also says it cleans firearms and fishing reels, protects against rust and fingerprints. "Moving parts work smoothly — never get gummy."

All that well may be, but it is a good idea to keep WD-40 well away from loaded ammunition because it is one of the



The recent trend in primer packaging has been to give each primer its own individual niche, as in this deck of Federal #210Ms. It's better to leave them in their package until used, not to dispense them loose.

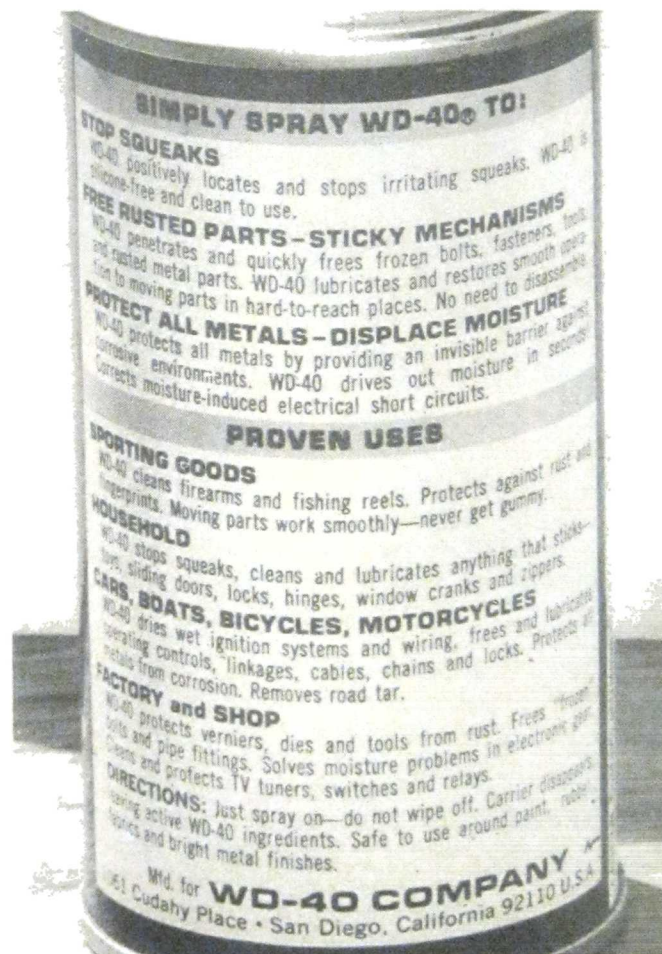
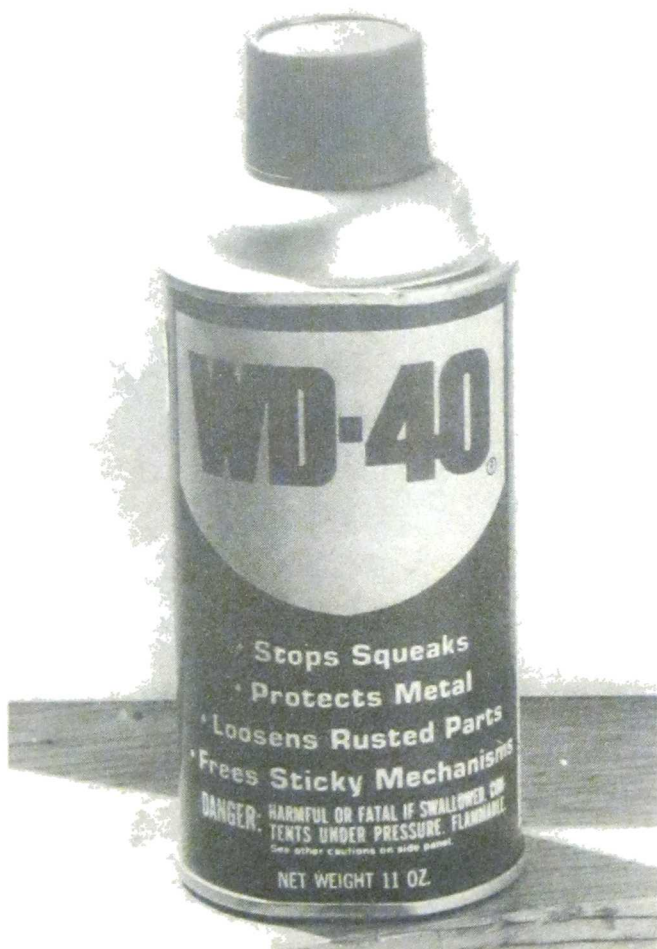
lubricants that can deactivate or impair the performance of both powders and priming compounds and its energetic penetrative properties enable it to work its way in past seated primers or bullets to get at the vulnerable materials. Used with suitable care and restraint, WD-40 is quite harmless, providing it can't get at the primer or powder. Some shooters take the attitude that "if a little is good, a lot

is better," and give a heavy spray of WD-40 over the heads of the cartridges in a revolver chamber before closing it and putting it away. If that is done, there is a substantial probability that cartridge performance will be weakened or that the cartridges will not fire at all.

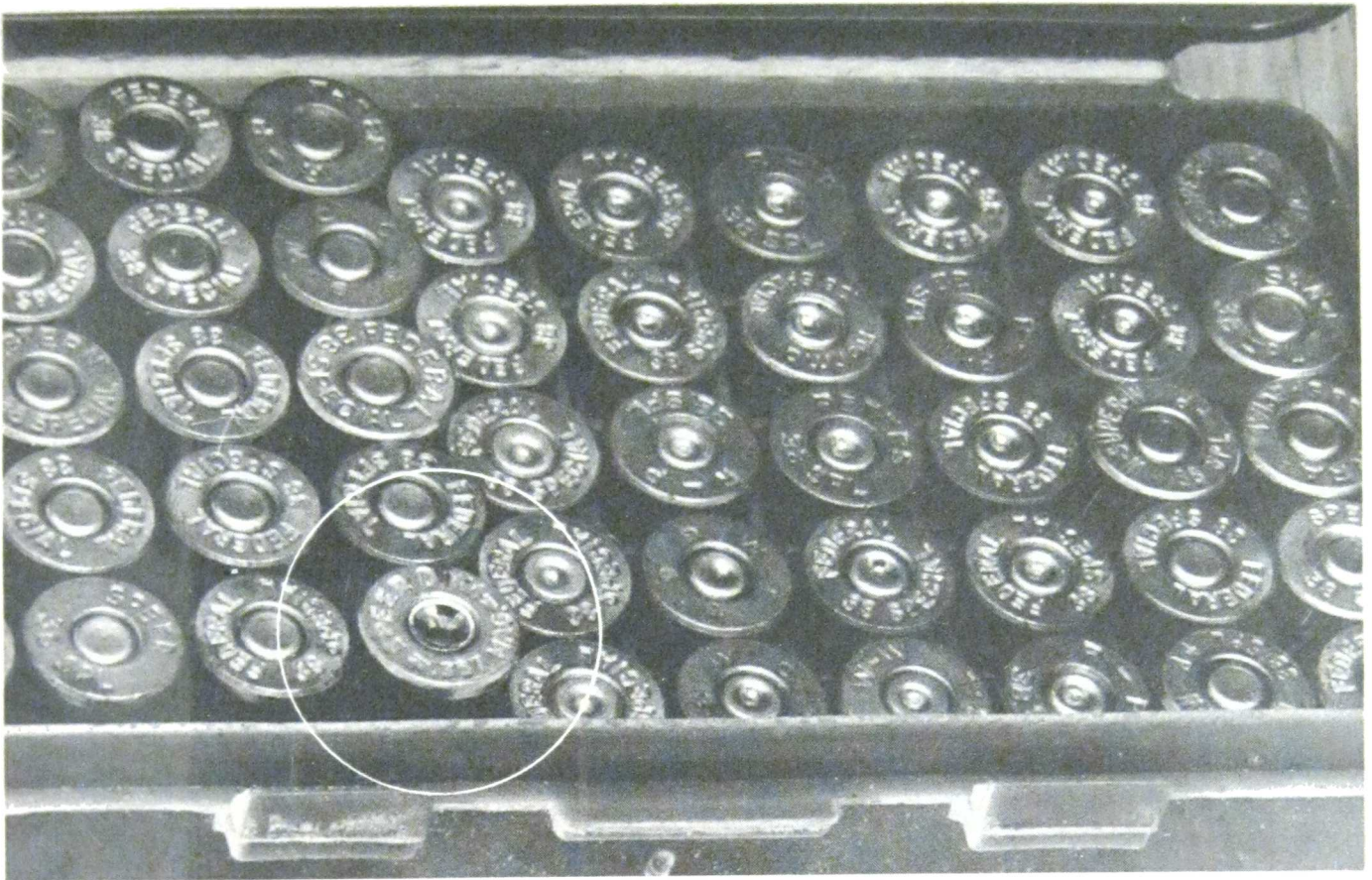
Most petroleum-base lubricants possess more or less the same properties, though few excel WD-40 in ability to penetrate into inaccessible areas. I've seen claims that some of the synthetic lubricants are harmless to powder and/or primers. This may or may not be true. It was pointed out elsewhere that lubricant of any sort, by its very nature, poses problems if it gets between the case and chamber walls. That's because it permits the case to slide rearward upon firing, imposing added stress on the action. You don't want lubricant in the chamber and I try to keep it off the cartridges for that and other good reasons.

Another cause of erratic primer performance is insufficient seating depth. Provided the primer is a suitable fit to the primer pocket in the first place, when seated, the surface of the cup should be slightly below the surrounding surface of the case head. Some say .005-inch lower, but manufacturing tolerances can introduce minor variations.

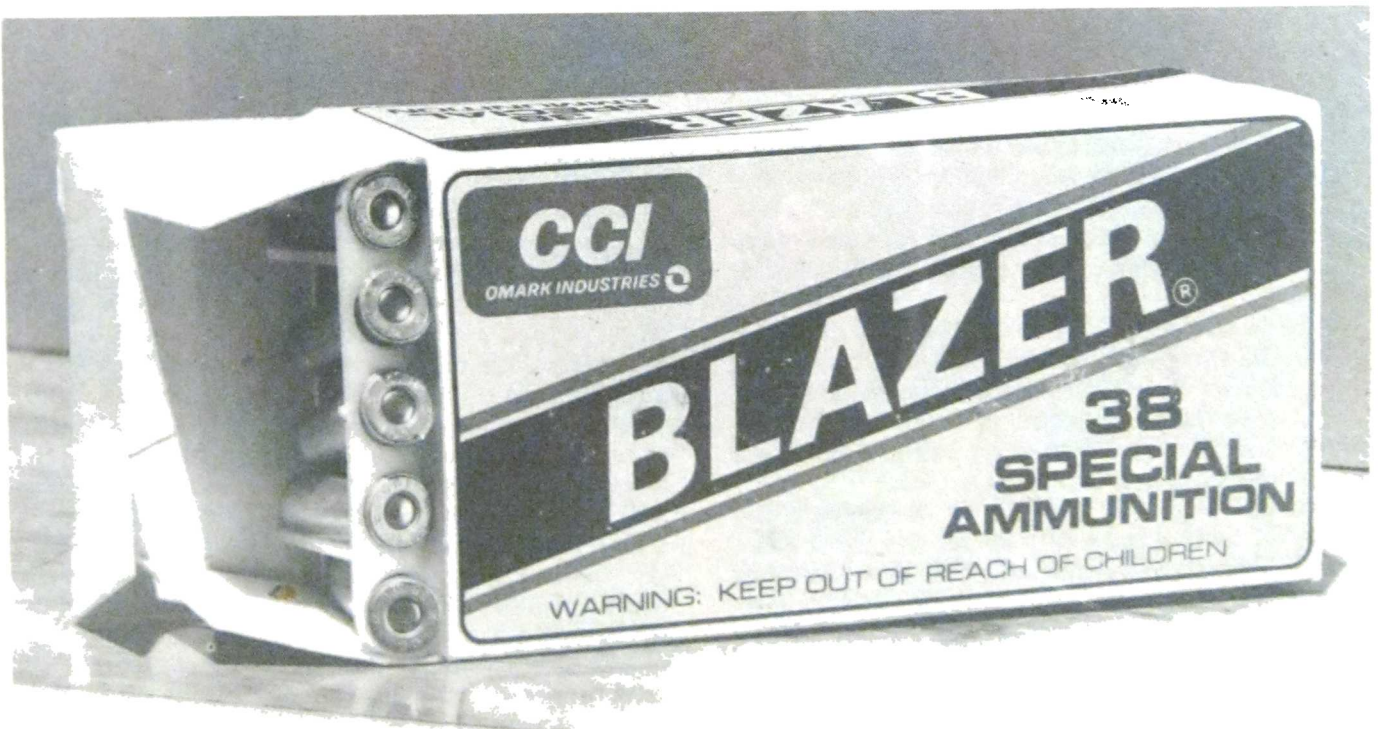
The device used for seating primers needs to provide at least a moderate amount of leverage. You want to seat the

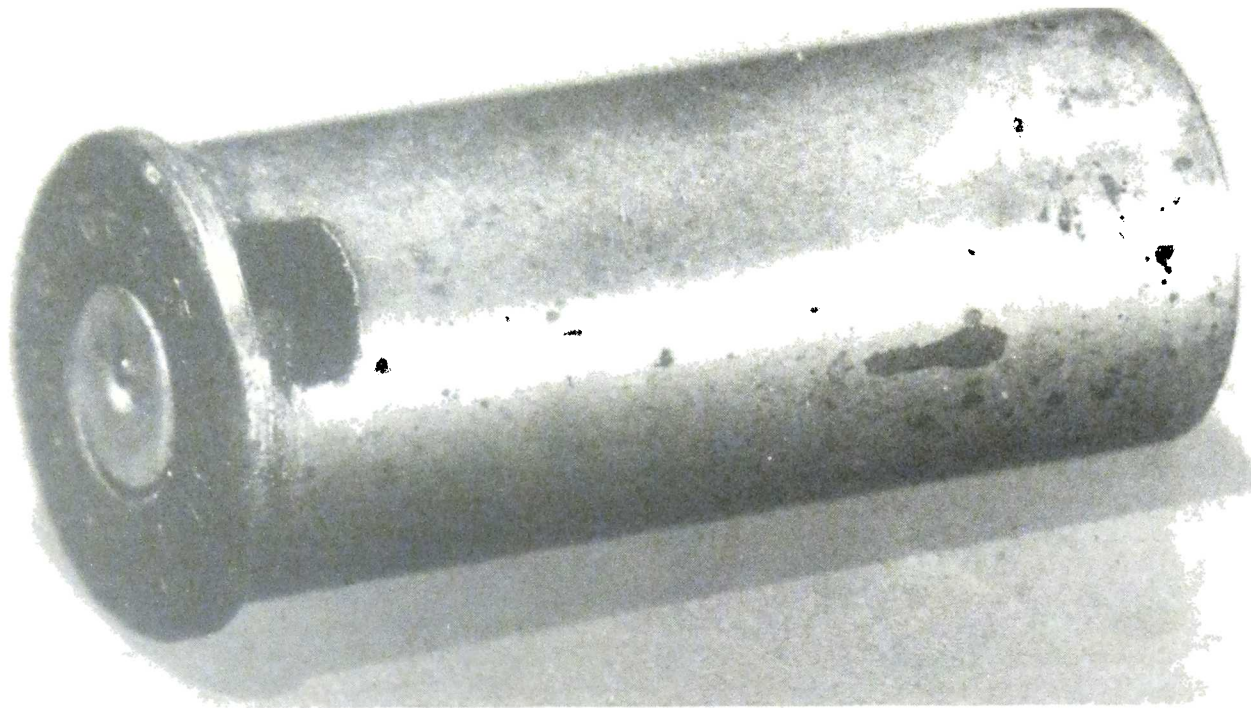


Front and rear label data on a pressurized spray can of WD-40 which, as discussed here, is one of the products that can weaken or deactivate both the powder and priming compound of loaded cartridges if applied carelessly.



Above: The cartridge encircled here in white has its primer seated backward; an all-too-common defect in reloading as discussed in text. Inspection of seated primers should be a routine procedure. (Below) Blazer cartridges from Omark/CCI have aluminum cases and Berdan-type primers. They are not reloadable





Here's the old balloon-head .44 Special case that somehow got mixed in with a batch of the newer web-head cases. Loaded to rather warm levels, it was fired in a Model 788 Remington bolt-action rifle chambered for the .44 magnum cartridge. Both the .44 magnum and newer .44 Special cases have solid brass in the area relieved for the extractor of the M788 rifle, but the old balloon-head only had thin brass at that point and it was blown away, putting the extractor practically in orbit: a good argument for deep-sinking the balloons!

primer firmly, to the bottom of the primer pocket but, at the same time, you do not want to seat it with so much pressure it deforms the primer cup. Many reloaders prefer to seat the primer under moderately firm pressure, rotate the cartridge in the holder a half-turn and then repeat the same amount of pressure. That is an approach that seems to work well.

A third cause of primer misfires is a blow of the hammer or strike of the firing pin that packs insufficient force to dent the cup and crush the wafer of priming compound. Revolvers tend to be the prime offenders in this respect, particularly those that have been worked over to produce a light and smooth double-action trigger pull.

If you have a primer that rests in its pocket, a few thousandths short of being fully seated, and give it a DA pull in a super-slicked revolver, the odds of the cartridge firing become pretty unattractive. The light rap of the hammer may move it on to fully-seated position, leaving a shallow dent in the cup and a second pull of the trigger may fire it.

It is by no means unknown for a primer to get seated in reverse, leaving the anvil and foil visible in the center of the case head. There is virtually no possible way such a cartridge can fire and it's rather unlikely the firing pin will set off the priming compound because the center of the anvil is well below the case head. One good thing about packing your reloads in a container such as the MTM Case-Gard is that it makes it easy to spot that particular mistake.

If you examine the heads of fired cartridges in a revolver, before pressing the ejector rod, and note that some of the indentations or all of them are well off-center, regard that as cause for alarm and concern. It suggests the timing and lockup of the cylinder are out of correct adjustment. Even a lusty blow of the firing pin, if far enough from the center of the priming cup, may fail to set off the primer. Be mindful, also, that such a condition means the chamber is out of line with the rear of the barrel and the cartridge and, if it fires, will drive the bullet out of the chamber, requiring some very rapid adaptation of the bullet to turn the corner and make its way on down the bore. In extreme examples of



Primers customarily have a lot number imprinted somewhere on the individual package, such as the A-6225 visible on inner surface of flap at right here. If you have reason to correspond with the manufacturer due to problems with primer performance, it is helpful to supply the lot number, although such problems are rare.

that condition, it is possible to blow up revolvers of admirably sturdy design and construction, even if firing factory loads or reloads made up to levels well below maximum. No one makes allowances for a bullet that has to jog around corners to get at the barrel.

Avoid picking up or handling primers with oily fingers. Any small remnant of case resizing lube can and probably will degrade primer performance and reliability. If your fingertips feel slippery or sticky, take a paper towel and get them clean again. A drop or so of lighter fluid helps, but use it sparingly.

BERDAN PRIMERS

Curiously enough, the Berdan primer was invented by a citizen of the USA and the Boxer primer was invented by a Briton. Today, the Boxer primer is almost universally used in this country, while Berdan primers are in common use throughout most of the rest of the world. Put another way, Boxer primers are appreciated where reloading is a common practice.

It is possible to reload Berdan-primed cases, but vastly more difficult than reloading cases of the Boxer sort. The Berdan primer consists of a shallow cup containing the wafer of priming mix and a disc of foil covering that. The primer pocket of the Berdan case has an integral anvil in the center, with two small flash holes off-center and opposite each other.

Obviously, the decapping pin of a conventional reloading die cannot knock out a Berdan primer and attempts to decap one are quite apt to result in a broken decapping pin. The usual technique for removing a Berdan primer is to use a special tool that pierces the radius of the primer cup with a sharp prong and pries it out by strong leverage. Seating a fresh Berdan primer poses no special problems, although they differ in diameter from the two Boxer types and require a priming punch of the correct dimensions.

The 9mm Luger is the cartridge most apt to provide examples of the Berdan primer, although it's not unknown to encounter Berdan-primed .45 ACP and other calibers. A close look down the mouth of the empty case, as you're



There has not, to the present, been a magnum-type shotshell primer duly designated as such and CCI says the M in their #209 M primer doesn't stand for magnum, but note the boxed warning on the packing sleeve that says to either use data worked up for the 209 M or, alternatively, reduce powder charges by ten percent.

sorting and inspecting brass under good light, usually serves to spot the telltale twin flash holes. Either discard or segregate such cases to prevent them getting back into routine production.

FURTHER COMPLEXITIES

Another unlikely variant to watch for is the old *balloon head* case, sometimes called the folded head. Modern case design is termed *web head* and the balloon jobs usually can be spotted by a close look down the neck under good light. The distinctive small moat around the flash hole protrusion is fairly apparent.

Most balloon head cases will be encountered in the revolver calibers that have been around since the turn of the present century or so. Those include, but are not limited to, the .44 Special, .45 Auto Rim, .38-40, .44-40 and .45 Colt (often termed Long Colt).

Balloon heads have somewhat greater internal capacity

than do web heads, contributing to non-uniform performance if loaded and fired as a mixed bag. Worse, the balloon head is quite a bit weaker, thereby passing a lot of the firing stresses to the chamber walls, as compared to the web head.

A maverick balloon head, finding its way in with the main herd of web heads, can cause severe problems. I have a nice old Remington Model 788 rifle in .44 magnum long since discontinued in that caliber. I decided to test some pretty warm .44 Special loads in it one day and came to one put up in a balloon head case. It cut a remarkably neat little rectangle right through the thin case wall and blew the extractor off the bolt to the bourne of no returning. Getting a fresh extractor for that cherished rifle was no small problem but I'm glad no one was in the trajectory of the lost extractor! Again, regarding the balloon heads, segregation or deep-sixing is the best course, with much to be said in favor of the latter.

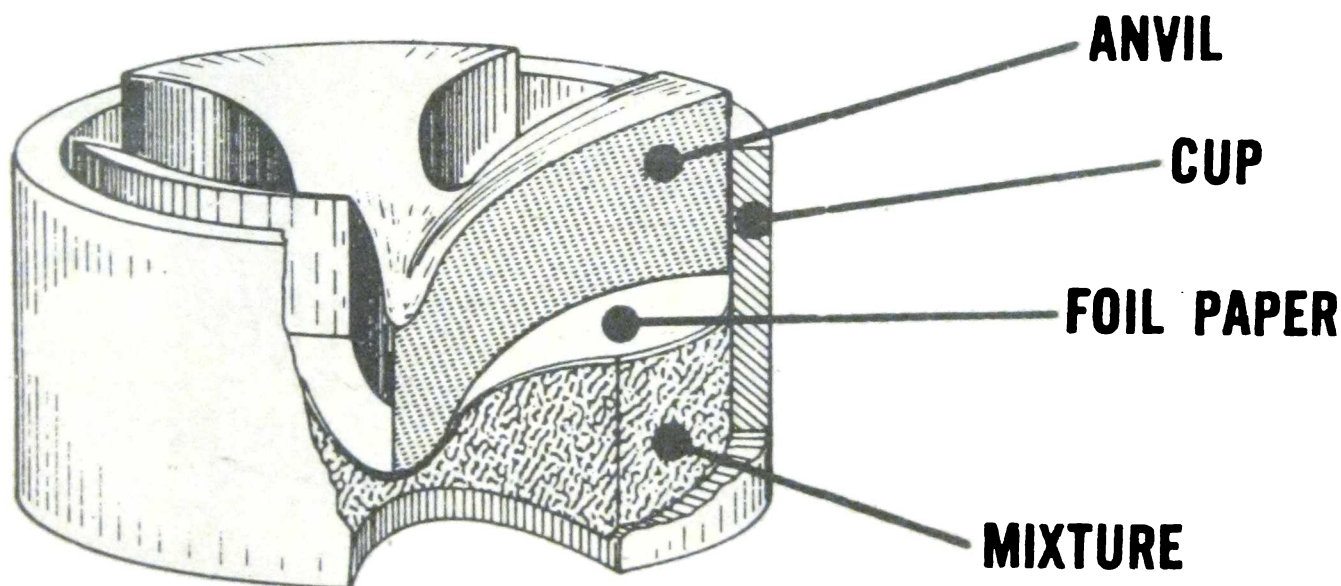
Brass cases tend to remain in circulation for a *long* time. Thus, it's possible, though unlikely, you may encounter weird relics from the receding past such as some of the old .38 Special cases with primer pockets for the large pistol size. As has been noted, some cases used to have flash holes of smaller diameter than those of today and if you try to decap such a case with one of the modern decappers having a punch of .068-inch diameter or thereabouts, it will seize the pin in its brazen clutch and wrench it bodily from the collet of the decapper rod.

You will discover that has happened when you try to pluck the case from the shell holder. The stuck pin will have locked it into the holder. Remove the holder from the press and use a small nail-set with a concave tip to drive the pin back out of its predicament. Such undersize flash holes can be restored to contemporary diameter by careful reaming with about a #48 or #49 drill bit.

If you scanned lightly over Chapter 2 on safety in reloading, I suggest you back and review the comments on

handling primers. Sharp percussion can set them off because they're *designed* to do just that. A further thought on the matter: If you use a press that drops its spent primers into a handy container and if you have reason to suspect there may be a few live primers lurking down there with all the dead ones, take your pressurized can of WD-40 and give the accumulation a generous spray from time to time.

You should become reasonably familiar with the appearance of a typical flash hole to the point where you get alarm signals if you see one obviously oversized. Perhaps someone was using wax or rubber practice bullets and enlarged the flash hole to prevent primer set-back upon firing the powderless load. That usually helps correct the problem, but it poses another big, hairy problem if such a case finds its way back in with the rest of the normal cases, undetected. If you make up such modified cases, apply a distinctive color to them for ease of identification. If you fall heir to cases that have been used by other people, you need to watch out for all sorts of things such as this.



In this drawing, courtesy of Omark/CCI, we can see the construction and layout of a typical primer for use with handgun or rifle cases. The protrusion of the anvil legs beyond the edge of the primer cup serves to pre-stress the water of priming compound at the time of primer seating, thereby aiding uniform ignition.

POWDERS — WHICH ONE, AND WHY?

Notes, Comments And Miscellaneous Observations
On Things That Go Boomp In The Gun...



The fine print reads, ".30/06 — W.S. Springfield #1459380 — 5 shots — 100 yards — 25 July, 1965 SPEER 165-grain bullet — NORMA Cases — FEDERAL #215 Primers 53.0 grains Hodgdon's #H380 Powder Approx. 2790 ft/sec." The little aiming spot measured 3/4-inch in diameter and I thought it pretty good for a rifle that only cost \$25, with 8X Weaver scope. Dave Andrews shudders when I run photos of old Speer products.

ONLY A SMALL percentage of the many different powders made up by the rather small number of manufacturers are ever offered to the reloading market as what we term *canister* powders. That refers to the powders marketed in small containers or canisters and listed in the various sources of load data.

Even so, the choice of available powders may seem so broad as to be more than slightly bewildering, particularly to those as yet unacquainted with the traits and characteristics of the several different types.

Many powders span a broad range of applications. Hercules Unique comes readily to mind in that context. Within limitations of data given in the books, Unique can be used for fairly heavy handgun loads, for reloading shotshells and in light loads for rifles.

Many shotshell powders work quite well in handgun loads, but the converse isn't necessarily true. There aren't many, if any, shotshell recipes that call for Hercules Bullseye or Winchester 231, as a couple of examples.

Powders come, powders go. Their popularity with the reloader is not the only factor at work. The complexities



Here we have a vivisected specimen of authentic British military ammo in caliber .303 British, complete with its little card over-powder wad and several translucent-tan strands of indubitable Cordite; the number that makes up the charge for one cartridge. Please don't ask me how they coax all those strands into the case!

and red tape involved with importing powders made overseas have lost us a number of excellent propellants, as in the example of Alcan AL-5 and AL-7, made by Bofors of Sweden. Even domestic powders can fade from the market, despite a brisk demand for them. The reason there, more often than not, lies in the manufacturer's difficulty in producing a batch or lot that meets their own specifications for release in canisters.

The key factor is the burning speed of the powder, in response to the peak pressure involved. That fairly well releases a big bag of snakes and I must beg your indulgence while we wax technical for a bit.

It has been a popular thing over the past many years to rank the various canister powders in terms of their relative burning rate, usually with Bullseye as the fastest and Hodgdon 5010 as the slowest of the numbers more or less available to the reloader.

The problem, you see, is that if the chart is set up on the basis that the maximum working pressure is a given figure for a select batch of powders, the ranking comes out one way. If, on the other hand, you raise the peak pressures by another 10,000 copper units of pressure (c.u.p.) or so, the ranking can and probably will be rearranged, perhaps rather drastically.

I trust you can see the obvious problem? If you make the flat statement that this is the way they stand, it may or may

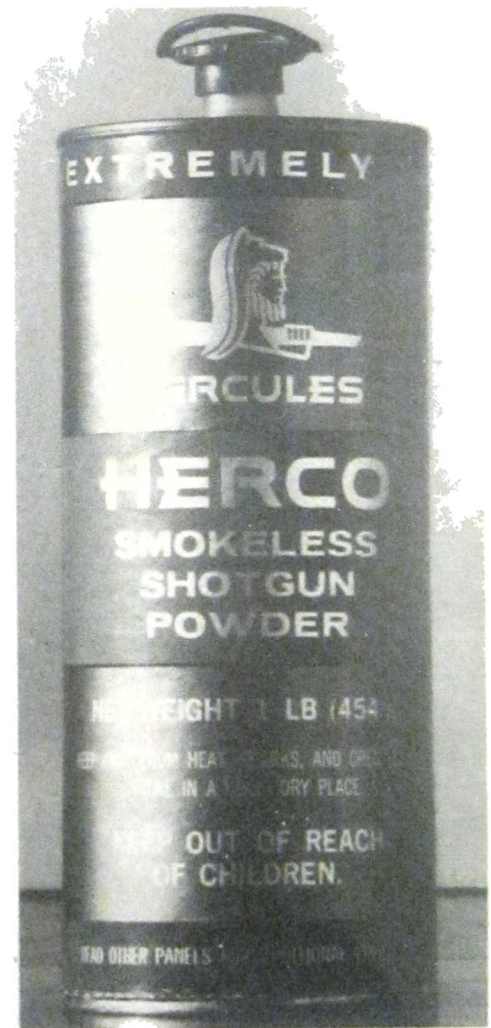
not be factual, depending primarily upon the peak pressures involved. Nonetheless, the reader — or *some* readers, at least — tend to take the basic list as utter gospel and proceed to interpolate and extrapolate upon it from there. As an illustrative example, they may assume that if 8.0 grains of XY-397 is okay, then the next-slower powder, OICU-812, can be loaded to 10.0 grains for the same application. Both powders mentioned are entirely imaginary, be it hastily noted.

Back to specifics: Hercules Red Dot is a most excellent powder, when used by the book. If the charge is increased only a little, however, it tends to develop a *lot* higher peak pressure, meanwhile only producing a modest increase in velocity. Red Dot often displays highly gratifying accuracy as the propellant for mid-range target loads in cartridges such as the .38 Special or the .45 ACP, but it should not be loaded beyond the modest charge weights given for it in the books. By "books," I refer to the reloading/handloading manuals/handbooks, of course. Or to the guides, for that matter. This observation about Red Dot applies primarily to its use in cartridges for handguns.

Powders are manufactured in large batches, called *lots*. The container usually bears a *lot number*, somewhere on or about its outer surface and, if you have occasion to correspond with the maker as to its performance, quoting the lot number from the can involved is highly helpful and per-



Left: 630 and 680 are two useful medium-speed powders for heavy handguns and small rifle rounds. The 630 has all but disappeared from the market. (Below) Herco is one of my special favorite powders, but read and heed the cautionary comments given here!



tinent. In the same vein, primers and loaded factory ammo usually (virtually always) carry lot numbers.

Any specific powder can and usually does vary slightly, both in density and burning characteristics, from one lot to the other lots. Uniformity within the given lot number tends to be highly consistent, to the best of my knowledge and experience. Often, the consistency from lot to lot is remarkably close. My experience with Bullseye is that it is remarkably unvarying. Its density may fluctuate slightly, but the net performance remains surprisingly constant.

Having several different lots of Bullseye on hand, I once ran tests of identical loads using three different lots. With a fixed-rotor measure — the RCBS Little Dandy — the combined weights of ten charges might show a variation of as much as one grain from lot to lot. That's to say, 0.1-grain for each charge. Nonetheless, when five of the resulting loads were chronographed and the velocities were averaged, the variation was minor, about what you'd expect if you averaged two five-round batches out of the same can.



After Bruce Hodgdon sold many-many tons of 4831 surplus powder (can at left), Du Pont brought forth their IMR-4831 (can at right). When Hodgdon sold the last of his surplus stock, he had the stuff newly manufactured in Scotland (center can). Although similar in properties, none of the three are exactly identical and both Du Pont and Hodgdon prefer that you use Hodgdon data for Hodgdon powder/Du Pont for Du Pont powder: so, for that matter, do I. Hodgdon refers to it as H4831 in their #24 manual, but note it's plain 4831 on labels here.

Hercules Herco powder is a great favorite of mine for use in handguns. I use it quite frequently when I reload the 9mm Luger, as one example because it is energetic enough to deliver excellent velocities from the tiny powder-space available in the small case and it has given me some of the tightest groups I've ever had from that cartridge: less than 1½ inches in spread for five shots at fifty yards, out of the Ransom Rest.

Some years back, several of the books carried numerous listings for Herco in the handgun sections, but many of these have been dropped from recent editions. I quizzed a source within the industry as to the reason and, per request, will not identify him/her/them/it.

Source: "Like you, I'm fond of Herco and I use a lot of it in making up my own reloads, particularly for the 9mm Luger. We dropped it from our listings because we just had too many complaints from users of the book that our loads produced excessive pressures.

"Investigating, we learned that the maker runs tests on it as a shotshell propellant, at typical shotshell pressures, but does not run comparable tests at typical 9mm Luger pressures before releasing a given lot. Occasional lots, if loaded to charge weights that are just fine with other lots, can produce excessive pressures. With that in mind, we stopped listing it."

That's not a verbatim quote, but I think it's fairly close. In noting this, I most sincerely hope I do not offend any of the good folks at Hercules, for such is certainly not my intention. As you will come to suspect in wading through this and other books I've written, I use a lot of Hercules powders, including Herco, and am appropriately grateful for the excellent results they deliver.

My purpose — and I do have one — is solely to urge and advocate some amount of sensible prudence when you open a fresh container of any powder and every powder, regardless of make and type. Note the lot number on the can you've just emptied, comparing it with the lot number on the new can. If the numbers are different, take the eminently sensible precaution of reducing your usual working charge weight by a bit, making up a few test loads at the lower weight and try them out before going back to your usual load. Work back up to your customary load gradually, by small stages. You may find it is possible to load a trifle more out of the new can, or that it delivers better groups. If that's true, I'd suggest you go back to the place you bought it and snaffle onto a few more cans out of the same lot. As noted, you can then live it up royally until the supply is exhausted and then it's time for the same sort of cautious reconnoitering, all over again.

How much to reduce the charge weight? Well, if it's a

700-X is a fine performer in target loads in revolvers and in target loads in the large shotshells. Reasonably reduced price tags represent the purchase price at The Gunright in nearby Fullerton, California.



fairly easy-going load, not at the thin brink of disaster — and that is definitely the sort of load you should favor — then five to ten percent reduction seems reasonable; fifteen percent if you feel timorous. If you regard it as a fairly hot-sopple load, right up there at the peak of performance, then ten to fifteen percent reduction is none too much until you get reacquainted with the characteristics of the new lot.

MAKING SMOKELESS POWDER

First off, it isn't necessarily smokeless but it came to be called that as it displaced the older black gunpowder, which was smoky as all get-out. It is sometimes called *nitro powder*, but in point of fact, the major ingredient of black powder was and still is saltpeter or potassium nitrate. Black powder is a physical mixture of saltpeter with charcoal and sulfur. Smokeless powder, as we shall continue to term it, is composed of *nitrocellulose* to a considerable extent, with a few other ingredients to modify or

improve its performance to taste. Powders composed of nitrocellulose alone, with a few modifiers, are termed *single-base*. Rather commonly, some percentage of nitroglycerine is blended with the nitrocellulose and other trace ingredients to produce what we call a double-base powder. For convenience, we may use the abbreviations of SB and DB in discussing them, not to confuse the latter with decibels, the unit for measuring sound, which is rightfully abbreviated as dB.

Both nitrocellulose and nitroglycerine are chemical compounds in their own right, with their individual molecules embodying some given number of oxygen atoms that serve to support combustion within the cartridge case where no air is available. Having the necessary oxygen available in the molecule itself, rather than merely nearby, improves the combustion efficiency quite remarkably.

Before discussing the basic rudiments of powdermaking, I want to point out that it is *not* suited as a do-it-yourself activity. Successful and reasonably safe powder



Cans of powder carry lot numbers, although, as in this example, you may have trouble deciphering them.

production requires a large, complex, highly sophisticated facility staffed by personnel with an intimate familiarity with the process involved. Even with all that going for them, the resulting product does not always turn out quite the way they wistfully had in mind, but their odds are a lot better than those available to the casual amateur. I do not try to make my own powder. I warmly urge you not to, either!

Raw cellulose takes many forms, as derived from various forms of vegetation. Wood is largely composed of cellulose, as are several types of vegetable fibers, such as cotton. Powder can be and has been manufactured from wood pulp and the distinctive term for the end product is nitrocellulose. It is much more customary to use cotton linters as the starting point. Those are the shorter cotton fibers, as separated out during the processing of the cotton bolls. The linters are of little use in making cotton cloth and their use in making powder represents an effective utilization of a product of limited value for other purposes.

After being washed and suitably processed, the cotton linters are put into a bath of concentrated nitric acid (the formula is HNO_3) and the process of nitration commences. One of the by-products of nitration is common ordinary water (H_2O) and that tends to bring the process to a stop, through dilution. To take the water out of the action, they introduce concentrated sulfuric acid (H_2SO_4), which has a powerful chemical affinity for water and combines with it, leaving the nitric acid free to get on with its assigned task.

Nitration is continued until the desired percentage of nitrogen has been reached. The exact proportion varies in accord with process requirements; something on the rough

Hodgdon's H240, in the early Sixties, was marketed as having much the same loading traits as Hercules 2400, here in a canister from about the same era.





H4895, originally marketed as surplus, was the powder used for military .30/06 ammo in WWII. Again, Du Pont introduced their own labeling as IMR-4895, some years later. As with 4831, check maker's data.

order of up to thirteen percent or so. The exact specifications aren't important because I'm not going to make the stuff and neither are you (promise?).

At that point, with nitration to the proper level, the emerging *guncotton* is strained out of the solution and put through an exhaustive and nearly endless series of washings to get the very lastmost tiny traces of residual acid out of it. Any acid left in the powder will louse up its long term keeping qualities to a fare-thee-well.

At this point, the reader who earned good grades in high school chemistry class (as did I) is apt to notice a glowing 60-watt light bulb above his/her head and suggest they introduce some chemical ingredient of an alkaline nature to serve as a preservative agent by nullifying and neutralizing any random remnants of acid. Why not leave it with a dash of, for example, calcium carbonate?

Well, as a matter of recorded fact, that was tried once. I disremember the exact nitty-gritty details but still recall that it preserved the powder just fine. It didn't spoil and remained fresh and vigorous, year after year.

The problem turned up when cartridges loaded with the given powder were fired. The calcium carbonate did not burn, remained unchanged during combustion and, having no place to go, deposited itself on nearby surfaces, adding a fresh layer of itself, each time a new round was fired.

I can see my fellow chemistry whizzes nodding thoughtfully. For those who did better in accounting, I'll note that calcium carbonate is another term for common limestone. Don't feel badly: I counted myself lucky to get a D- in bookkeeping.

You may recall a considerable hoo-hah that occurred in the late Sixties over the malfunctions experienced by the



As with the 4895 types, the same caution applies to Hodgdon H4350 and Du Pont IMR-4350. They're different enough to pose problems if you don't.



H335 and H322 are capable of gorgeously tight groups in the smaller cartridges such as 223 Rem

troops in Vietnam when using the caliber .223 (5.56mm) M-16s that had recently been adopted as the U.S. service weapon? After firing some given number of rounds, the little gas pistons would seize up and render the weapon inoperative. Cleaning and restoration of further functioning was no simple matter. The vital inner gizzardry was plated with limestone and that is an absolute puppy-mother to remove.

Any chemical cleaning agent that removes calcium carbonate vigorously will, in so doing, raise holy Nellie McGillicuddy with nearby parts and components made of steel, including most if not all alloys of stainless steel. Acetic, nitric and hydrochloric acids will roust limestone nicely but it is a chemical fact of life that all metallic acetates, nitrates and chlorides are water-soluble. Sorry about that!



Winchester continues to offer an extensive line of powders for use in reloading shotshells. Unlike some other powders, these are seldom if ever listed for reloading handgun ammo.

Well, so much for what seemed like a good idea.

Forgive, if you can, the tangent we've been exploring. Let's get back to the nominal topic. The nitrated cellulose is washed; scrupulously and likewise fanatically. A powder mill needs to be situated close to an inexhaustible supply of fresh water of suitable chemical analysis. Yes, their monthly water bill must be a frightsome thing. That done, the purified nitrocellulose is dissolved in suitable solvents and an appropriate amount of the solvent is evaporated to leave the well-mixed product in the form of a plastic dough. That, in turn, is pressed through orifices to extrude it in strands comparable to microfine spaghetti and, as that is going on, rotary cutters snip off the extrusions into the short rodlets or fine flakes with which we are more or less familiar.

Some extrusions leave a tiny hole in the center of the granule. Few reloading powders have more than a single central hole. The purpose of that is to achieve a modified or progressive burning characteristic.

Consider, if you will, that a powder granule burns solely at its surface. As the ambient pressure increases, combustion takes place closer and closer to the surface. As a solid granule burns, its outer surface area is reduced at a drastic rate. A central perforation, however, increases in area as the granule is consumed, serving to keep things a-whooping as the projectile commences to move up the bore, thereby making more volume available for the combustion's by-products to occupy.

The really huge granules, for use in artillery and the like, may have six or seven central perforations to aid in the useful effect just described.

Nitroglycerine, if added, is introduced during the plasticizing or dissolving in solvent mixtures. Other modifying trace ingredients are usually added at the same time.

That is the usual procedure for making the so-called *extruded* powders. Such numbers may take the form of thin flakes or disks, with or without a central perforation, typically for use in handguns or shotguns. Most extruded powders for use in rifles have granules considerably lon-

ger, bearing a close resemblance to "lead" for mechanical pencils that has been broken into short pieces. Again, they may or may not have central perforations. Some powders incorporate both solid and perforated granules in a fairly uniform mixture.

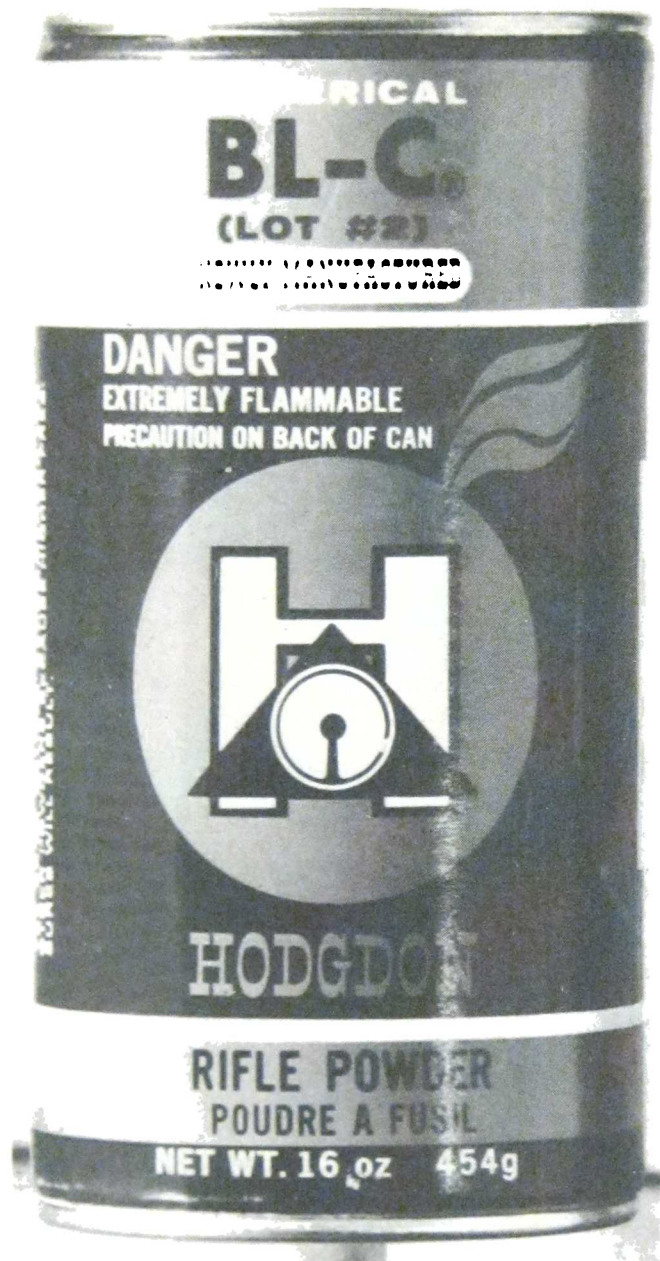
We have a further manufacturing variant that I will term *globular* powders. It encompasses both the *Ball Powders*® made by Winchester and the *Spherical*® types marketed by Hodgdon. The latter firm includes a number of extruded powders among its offerings.

Globular powders are produced by dissolving the nitrocellulose and/or nitroglycerine in a generous amount of solvents to make up a sort of lacquer that can be pumped through pipes to transport it from one processing stage to the next. Along the way, the solvent is gradually removed by controlled evaporation, allowing the active ingredient to solidify gradually into globules more or less spheroid in format. Under high magnification at that stage, the globules bear a considerable resemblance to the type of candy termed *bridge mix*.

As may seem necessary, suitable and indicated, the globules may be put through sets of rollers to flatten them slightly in order to modify their burning traits to the intended specifications. At the same time, coatings of deterrent chemicals can be applied, building up the layers like an old-fashioned "jawbreaker." I'm not quite sure why the comparison to candy has to keep cropping back up like this.

At any rate, the globular process is a highly flexible one, offering a nearly infinite choice of possible avenues and techniques to arrive at an intended end propellant. It can produce a powder capable of doing things no other can accomplish. To purloin a phrase popular among writers of ad copy for pipe tobaccos, some of the globular numbers are comparatively cool-burning. That tends to minimize the wear and erosion of the rifling within the barrel and that's certainly to the good.

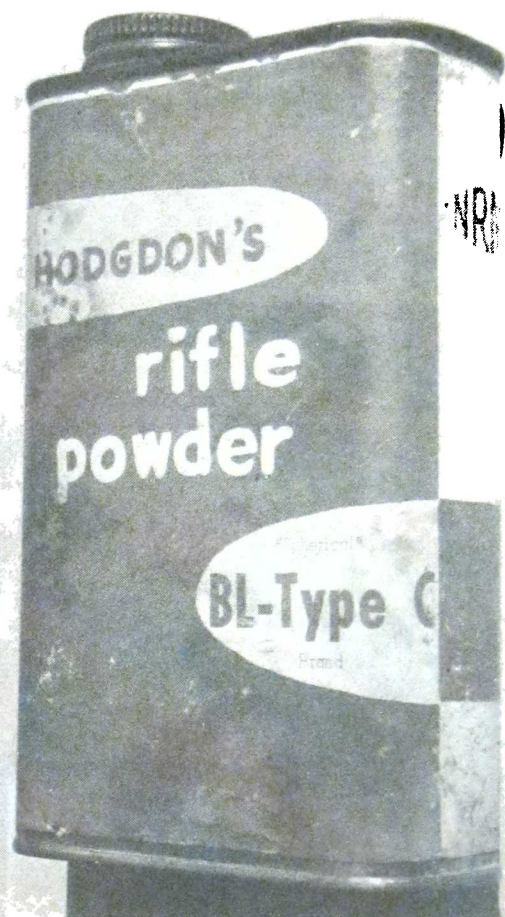
The finished batch of powder, as required, may be graded to pretty uniform granule size by passing through a series



The latterday BL-C #2 is another that's being newly manufactured for distribution by Hodgdon.

of sieves, after which the samples of the given lot are put through exhaustive testing to ascertain their burning qualities, pressure response and similar traits. If they meet the manufacturer's standards, within close specifications, they are packaged in canisters for sale to the reloading market. If they don't quite come up to the anticipated snuff, they are put up in larger containers for sale to commercial consumers. The ammunition factories have highly sophisticated test facilities and are amply capable of taking any given batch of powder and determining how much to load in order to arrive at a specified level of performance. Thus, as noted, there are a great many more non-canister powders than the canister types.

Reading back over copy fresh from the old IBM, I note I mentioned that globular powders are produced by dissolving the nitrocellulose and/or nitroglycerine in a generous



Here's a can for the original batch of BL-Type C as used for marketing in the early Sixties. These usually carried suggested load data on the labels.

amount of solvents. That is unacceptably ambiguous, but I don't see any ready way to edit it so as to make it, uhh, biguous. So far as I know, no propellant is composed entirely of nitroglycerine for its primary ingredient. Is it acceptable to rephrase that as, "nitrocellulose and/sometimes nitroglycerine" —? In point of fact, few globular powders are of the single-base persuasion. Offhand, I don't know of any that are. Does that help to clarify things?

Across the pond, our British cousins used to be fond of making up a propellant they called *Cordite*, and perhaps still are doing so. It was usually snipped off in lengthy strands about as long as the space available within the cartridge case and must have posed a challenge for use in high-production loading. Cordite seems to've carved itself a place in the language as a generic term for smokeless powder, despite the fact that a vast number of propellants do not qualify to be thus designated.

"The acrid stench of burned Cordite," recurs endlessly amid the pages of what I call corpse-operas in a sort of painful litany. Every time I encounter it, I'm hard-put to stifle an instinctive barf. If you ignite a strand of Cordite and sniff with due precautions, the olfactory impression is pretty damned acrid, for what consolation that may afford. The same wordsmiths partial to the phrase seem much given to equipping revolvers with safety catches. So it goes.



Here are four of several Hodgdon powders that have been discontinued over the years. Note the \$1.50 price marked on the can of Grey B, compared to 700-X!

POWDER SELECTION

I fear the foregoing may include information for which many a reader never yenned overkeenly. Those who wish it have my apology in a choice of seven flavors.

Powders, as noted, tend to come and go or, at times, to undergo a sea-change by modification, perhaps being redesignated, perhaps not. As but one example, when Winchester-Western, as then known, first introduced their Ball Powders to the reloading market in the early Sixties, they included two handgun propellants called 230-P and 295-HP. The first was intended for low-velocity target loads, the second for cartridges such as the .357 magnum at the upper end of their capability.

They dropped 295-HP rather early in the game and then came out about 1968 with a pistol powder called 630-P which lay roughly midway between the first two. Somewhere about that time, 230-P became just-plain 230. As calendars moved on into the latter Seventies, 230 phased over to 231, which remains available to the present. The 630-P became an unadorned 630 and another powder, termed 296, was introduced.

Having worked with both, I can report that 296 shares

certain common family traits with the long-gone 295-HP. For example, both require a loading density that leaves little or no air space within the cartridge and both want a firm grasp of case neck against bullet base. Most sources recommend the use of magnum-type primers with all Ball Powders and Spherical propellants, although as noted earlier, magnum primers alone won't do the job if the bullet is loosely held and/or if there is a lot of air space. To qualify that, 230-P, 230 and 231 did not/do not require high loading density. Follow the load data given in the books, by all means!

The good old 630-P abode its destin'd hour and went its way, rather early on. *Its load data is not interchangeable with 630, grain for grain.* If you load the same weight of 630 as originally specified for 630-P, you are going to have one goshawfully hot load. Perhaps it is just about as well that 630 powder has been extremely hard to find in the marketplace the past considerable while now. As I get the word, they keep trying to brew up a batch, but it never quite comes up to specifications. So they sell it as non-canister and try again.

A further Winchester powder of recent introduction is their 680, somewhat slower than 296 and engineered primarily for cartridges such as the .22 Hornet. In point of



We fans of 630 continue to hope it may return some day. The 296 is good stuff, but must be loaded strictly according to listed loads and not reduced below that.



Two slow-burning powders for big magnum rifle loads: other comparable powders are Hodgdon H870 and a new addition to the Du Pont line to be known as IMR7828.

fact, 680 has turned out to be quite useful for the heavier bullets in the .44 magnum, such as the 265-grain Hornady job and if you will consult the listing for the .45 Winchester magnum in the #10 Speer Manual, you'll note that 680 is by far the best performer in that cartridge, using heavy bullets. That's the good news. The bad news is that it's become quite a challenge to encounter a can of 680 that can be purchased. Much the same state of affairs as described for 630 applies.

Progressing along to the slower Winchester powders, there is 748 which works extremely well in cartridges such as the .222 Remington and .30-30 WCF. Their 760 is intended for the smaller, high-intensity cartridges such as .22-250 Remington, .243 Winchester and the like. Their 785 is engineered for the larger, gut-'em-out loads such as the .300 Winchester magnum, 7mm Remington magnum and their vigorous ilk.

HERCULES POWDERS

As was noted, Bullseye, if it did not exist, would require invention. It is pretty hard to beat for target loads in cartridges such as the .38 Special and .45 ACP and, curiously enough, it can impart some notably brisk performance from the 9mm Luger. Its flakes are circular, close to the same diameter as are those of Hercules 2400, although the latter are slightly thicker. Being a lot faster in burning rate than 2400, mistaking one for the other can get you in bad trouble and it has happened, various times that I've heard of.

BULLSEYE meters from volume measures surprisingly well, considering its fluffy properties. It thrives on lots of air space within the cartridge and it does *not* need the services of magnum-type primers. *No Hercules powder should ever be used with magnum primers!* All Hercules powders are of the double-base type.

RED DOT, as noted, is another fast-burner. As a general observation, when prudently used, by the book, it often delivers heartwarming accuracy. Nominally listed as slower burning than Bullseye, my personal impression is that it is just a squinch faster burning, but I do not propose to launch a crusade about it. If you itch to develop a nice, mild, tack-driving target load for a cartridge such as the .41 magnum, .44 magnum or perhaps the .45 Auto Rim, Red Dot is a possibility which you should, on no account, overlook. Go by the book.

GREEN DOT appeared in the early Sixties as slightly slower than Red Dot in ballistic getaway. Introduced as a



Labeled as a powder for magnum shotshells, Blue Dot is a remarkably effective and satisfactory propellant for heavy loads in magnum handguns, particularly with the lighter bullets; it also does well in the .45 ACP.



Ten charges of H110 dumped into the scale pan for weighing to determine the average weight of charge.

shotshell propellant, the early vintages showed promise for use in handgun loads but that no longer seems to be quite as much the obvious case. Green Dot is a superb powder for target shotshell loads. I can't think of any other powder that I'd prefer to it. I have, however, stopped trying to use it in handgun loads. It's just that other Hercules powders seem to perform better.

UNIQUE was mentioned earlier in terms of its notable versatility. It does everything, after a fashion. That's not to say that more specialized propellants can't beat it. Some of the books proclaim it as *the* powder for top results with the .45 Colt aka .45 Long Colt cartridge. I beg leave to disqualify myself as a witness in this matter. I own but one gun capable of handling the .45 LC: a Ruger Old Model with twin cylinders to take that and the .45 ACP. That particular revolver does much better with 2400 than it does with Unique.

I hardly use Unique from one decade to the next and, again, I hope in saying so that I don't rock any rowboats in Wilmington, Delaware. A lot of reloaders profess to adore Unique madly. They like it for hotrod loads in the .45 ACP, but I prefer Blue Dot for such uses. My objection to Unique stems from the fact its big flakes seem to meter with casual uniformity from volume measures and, further, it leaves a lot more unburned residue than I choose to cope with.

HERCO has already been given a fair amount of discussion, but I'll repeat it remains one I use in lavish quantities. Although physically resembling Unique, I find it meters quite uniformly and, given observation of its possible lot-to-lot foibles, I find it a dependable performer, admirable in any way I've ever been able to look at it. Personally, Herco has never given me any unpleasant surprises but, as noted, it is at least theoretically possible. I can but hope it works as well for you as it does for me.

BLUE DOT made its appearance in the early Seventies as the next slowest number in their panoply up the line from Herco and, as I understand, it has won a most secure niche for itself in the hearts of the nation's reloaders. For sure, it has won one in mine.

Blue Dot is not a good choice for mid-range target loads. Blue Dot is a promising propellant to try if you want to launch a lightweight bullet from a handgun at pretty brisk



Winchester 231 is a fairly fast-burning powder at its best for target loads in pistol or revolver cartridges.

velocities. Blue Dot requires some minimum level of pressure in order to get enthused into burning properly. Properly loaded, it seems to deliver excellent accuracy and, in so doing, leaves hardly any unburned residue worth mentioning. If Blue Dot went off the market tomorrow, I would feel as heartbroken over it as I continue to do about Alcan AL-5 and AL-7. Compliments more lavish than that I can't hardly put a finger upon.

2400 has been with us for a long time and, as with Blue Dot, I hope it remains. Like Unique, it can be used in handguns, shotguns and rifles, perhaps a bit more successfully in all three. In shotguns, its chief employment is for the .410-bore, as given in the books. In the larger rifle cartridges, it is strictly a light-load pusher, often doing remarkably well with cast bullets. In handguns, it is viewed by many as *the* powder for cartridges such as the .357 magnum, .41 magnum and .44 magnum. Its obtainable velocities are up there among the best and its capability for dotting in clannish wee groups often proves damned hard to beat. It meters out of volume-type measures with magnificent uniformity. It is not usually regarded as a logical propellant in the .38 Special but I've had some pretty good results, even in that maverick employment.

RELODER #7, commonly written as R7, is the only rifle-type powder currently in the Hercules line. Introduced in the early Sixties, along with R11 and R21, the line



These are Hodgdon's slower numbers for use in the large magnum rifle cases behind heavier projectiles.

was intended to take the place of the discontinued Hi-Vel #2 that was keenly mourned by a lot of reloaders (including, for sure, yours ever so truly!).

Reloder #11 was a pretty good and useful powder, I thought. Reloder #21 was somewhat perplexing. Cartridges made up to specifications with it might obturate — that is, expand and seal the chamber — quite nicely or, at random times, examination of the fired case would indicate that the powder gas had gotten in between the case and the chamber wall to leave extravagant amounts of residue, perhaps even to crumple the case to some extent.

Be that as it may, Hercules dropped both R11 and R21 after no more than a few years' run, retaining R7. The survivor is a pretty good powder, imho, but it needs to be utilized in strict conformity with published data. It is among the very last of the powders suitable for experimental exploitation. Like its distant cousin, Red Dot, it responds rather hysterically to injudicious boosts in charge weight. Given adherence to listed data, it delivers good accuracy and respectable velocities with the lighter weights of bullets in just about any rifle cartridge. In appearance, its granules are quite small and there are several different colors mingled in with the basic black: red, yellow and a sort of greenish-blue, as a usual rule.

HODGDON POWDERS

Bruce Hodgdon founded his far-flung empire as the echoes of WWII were dying out. In the course of floundering valiantly toward first V-E Day and then V-J Day, the Arsenal of Democracy, aka the U.S. of A., managed to produce truly prodigious quantities of assorted powders designed and intended for certain specific employments.

For example, there was H110, a Spherical propellant used in loading cartridges for the .30 M-1 carbine cartridge. There was a tubular propellant known to reloaders across the global surface today as H4895 that one presumes lent zest and crepitanace to the .30/06 cartridges, still widely used in that receding conflict. Along with H4895, there was BL-C, vocalized as "ball-see," and later to be designated as Spherical BL-C2®. At the slower-burning end of the spectrum, there was 4831, as it was known for a considerable while, later nomenclated as H4831® Newly Manufactured; likewise a tubular propellant. It is widely

believed that 4831 got launched as the go-dust for the 20mm cannon cartridge. For a lengthy while, Hodgdon also sold 5010. I do not recall it was ever designated as H5010, but would not bet tuppence either way. It is securely embedded in reloader folklore that 5010 was the motivating force for the caliber .50 Browning machine gun cartridge of truly awesome puissance.

All this more or less took place in that distant decade known today as the Fifties; the *Nineteen-Fifties*, if you please! There may have been other early powders, but the sharp details are obscured by the cobwebs of inexorably marching years.

Suffice to say if the stuff would burn, Bruce Hodgdon would bid upon it and, if it came his way, he'd try to find a good home for it. Give the good man credit: If he hadn't interceded, who knows how many tons of precious foom-fodder might've been summarily burned, merely to dispose of it safely?

As a humble aerial gunnery instructor, military occupational specialty or MOS of 938 for most of that trans-planetary conflict, I recall vivisectioning a round of .30 carbine ammo and marveling at the funny-looking powder it contained. I don't think I'd ever seen globular powder before. It was not until quite a few years later that a reloading buddy in the funny Wisconsin town sent to Uncle Bruce and got back a good-sized drum of BL-C, along with



H110 is highly capable and versatile. It can be used in .410-bore shotshells and magnum handgun loads.

a printed sheet of recipes for its use in any of several popular cartridges. It didn't cost much money, but it came back as a lot of powder and he dealt out quantities to anyone who'd take it, by way of getting his supply still in storage down to manageable levels. I took some off his hands, for free, transcribed the data — the ubiquitous Xerox was many years yet unborn at the time — and, as I recall, had pretty gratifying results with it.

Some while after that, quantities of Hodgdon surplus powder began turning up in gun stores around the area, packaged in containers of more convenient size. They included H240, which was loosely synonymous with Hercules 2400, and H4227 that sold for just \$1 the one-pound canister. I liked that so well and was so favorably impressed by the friendly price that — would you believe? — I still have a few pounds of it on hand, the better part of three decades later!

Some of the Hodgdon powders of those days used to come packed in cans with load data printed on the label; surely a helpful and constructive way of coping with the communication problem.

By the way, apologies are due and herewith proffered for mentioning these incredible prices at a time when just about any old cartridge-fuel goes for upwards of ten bucks the pound. Anymore, I only wish I'd been able to purchase more lavishly.

Hodgdon has marketed many different powders down the years, some of which have been discontinued as the supply was exhausted. Veteran reloaders will recall numbers such as Grey B, HS5 and H205 with nostalgic sighs. The line, current as of publication of the #24 Hodgdon Data Manual in late 1983 includes the following:

SPHERICAL HP38 — A fast-burning spherical powder which is adaptable to light or target loads in a broad range of pistol calibers. Especially recommended for target loads in the .38 Special.

SPHERICAL TRAP 100 — A spherical powder adapted to trap and light loads in the 12-, 16- and 20-gauge. Also gives fine results in light or target pistol loads.

SPHERICAL HS6 — A versatile heavy field load spherical powder especially adapted to 2¾-inch magnum loads in 12-, 16- and 20-gauge. Also performs well in the three-inch magnums and the 28-gauge. May be used for mid-range to heavy pistol loads.

SPHERICAL HS7 — New slow-burning spherical magnum shotshell powder which gives excellent results in the 12- and 20-gauge three-inch magnums. This powder is also the best powder available for the 28-gauge. It can also be used in mid-range to heavy pistol loads.

SPHERICAL H110 — A spherical powder made especially for the .30 M-1 Carbine. H110 also does very well in .357, .44 Special, .44 magnum and .410-bore shotshells. Magnum primers are recommended by Hodgdon for consistent ignition.

H4227 — H4227 is the fastest-burning of the IMR series. Well adapted to Hornet, light bullets in .222 and all bullets in .357 and .44 magnum pistols. Cuts leading with lead bullets.

H4198 — An extruded powder at its best in small- to medium-capacity cases. An excellent powder for .222 and .223 Remington. This powder now has a new popularity: heavy

loads in the .444 Marlin and .45-70 Government. A good powder for reduced loads with lead bullets.

H322 — An extruded powder which has proved to be capable of producing fine accuracy in the .22 and .308 benchrest guns. This powder fills the gap between H4198 and BL-C(2). Performs best in small- to medium-capacity cases.

SPHERICAL BL-C(2)* — A highly popular favorite of the benchrest shooters. Best performance is in the .222 and in other cases smaller than .30/06.

SPHERICAL H335* — Similar to BL-C(2), H335 is popular for its performance in medium-capacity cases, especially in .222 and .308 Winchester.

H4895* — H4895 may well be considered the most versatile of all propellants. It gives desirable performance in almost all cases from .222 Remington to .458 Winchester magnum. Reduced loads, to as low as sixty percent of maximum, still give target accuracy.

SPHERICAL H380* — This number fills a gap between 4320 and 4350. It is excellent in .22-250, .220 Swift, the 6mm sizes, .257 and .30/06.

SPHERICAL H414 — An excellent spherical powder in medium- to medium-large capacity cases. Outstanding accuracy has been reported in many calibers such as the .270 or .30/06. Does well in large-capacity cases with the lighter bullets.

H4350 — A slow-burning, extruded powder introduced in April 1982, this powder is fast becoming a favorite of many reloaders. It gives superb accuracy at optimum velocity for many large capacity metallic rifle cartridges.

SPHERICAL H450* — Best results are obtained in medium- to large-capacity cases, with this spherical powder. Its burning rate is similar to that of 4831.

H4831* Newly Manufactured — A new batch of the original 4831, the most popular of all the Hodgdon powders. Use same loading data as for the original surplus version. Outstanding performance with medium and heavy bullets in .243, 6mm, .25/06, .270 and magnum cartridges.

SPHERICAL H870* — An extremely slow-burning spherical number, adaptable to overbore capacity magnum cases such as .257, .264, .270 and .300 magnums with heavy bullets.

PYRODEX* — The first major improvement in centuries in a propellant for muzzleloading arms, it is designed for use in percussion muzzleloading firearms. Pyrodex gives the shooter less fouling, exceptional accuracy, more shots per pound and eliminates the need for cleaning between shots. Available in three grades: P, RS and CTG, full information for its use is provided in the #24 Hodgdon Manual.

The foregoing is lightly paraphrased from the opening pages of the #24 Hodgdon Manual and I'd like to add that in my own experience H110, H335 and H4831 are the powders that are my special favorites. H110 is, I think, the most effective powder for getting the last bit of safe performance from magnum revolvers although, as may be noted elsewhere, it needs a tight grip of the case neck on the bullet base and minimal air space between the charge and bullet base. Magnum primers don't hurt a bit with H110.

H335 has won a lot of warm and affectionate regard from me in comparatively recent times by its really astounding performance with the .223 Remington and wildcats based upon the same case. It powered the first loads in



H375 is another long-gone Hodgdon number and these two views are primarily for historic interest, showing the data listing that used to appear on the can in the days before Hodgdon's launched their series of loading manuals. The current Hodgdon Manual is #24.

Net wt. 16 oz.

LOADING DATA FOR SPHERICAL H375

CALIBER	CHARGE	BULLET	VELOCITY
222 Remington	27 gr.	50	3033
219 Wasp	32 gr.	51.5	3523
22/250	37 gr.	55	3555
220 Swift	41 gr.	50	3803
243	40 gr.	75	3107
244	44 gr.	75	3451
257	44.5 gr.	87	3148
270	51 gr.	130	3088
30/06	56 gr.	150	2951

Inasmuch as the methods in which powders may be handled, loaded and used after leaving our plant are entirely beyond our control, no guarantee is made as to the effects of its use.

New powders continue to appear, but none too often. Du Pont's Hi-Skor 800-X is primarily a shotshell powder with interesting applications in magnum handguns.



7mm T/CU with which I managed to get under one minute of angle (MOA) at one hundred yards with the T/C Contender and later, when the T/C '83 rifle appeared, I used H335 to get its groups down comfortably below one-half MOA at 115 yards. It is awfully difficult to keep from loving a powder that enables you to do such pleasant things.

My fond regard for H4831 stems from a dozen or fifteen years ago when I used it to dot in a group that went less than one-half inch at a distance of two hundred yards with my pre-'64 Model 70 Winchester in .300 Winchester magnum. That was with 75.0 grains of the original surplus H4831 — of which I still have a gallon or so — and the 150-grain Hornady spire-point bullets. Any powder that gets below one-quarter MOA in a cartridge that potent has a lot of good stuff going for it, imho.

I should note that H4350 is apparently a bit faster burning than Du Pont's IMR-4350 and both Hodgdon and Du Pont urge reloaders to use the specific load data for one or the other and not to cross party lines. I second that motion.

DU PONT POWDERS

This firm began manufacturing powders in 1802 and grew to be a giant in the chemical industry. Until fairly recent times, they continued to operate a plant making black gunpowder at Moosick, Pennsylvania, but sold that to Gearhart-Owen.

The current line includes fourteen smokeless powders, variously suited for use in handguns, shotguns and rifles, with some capable of being used for two or all three purposes.

The Improved Military Rifle (IMR-) series — ranging from fast to slow in burning speed — includes IMR-4227, IMR-4198, IMR-3031, IMR-4064, IMR-4895, IMR-4320, IMR-4350 and IMR-4831. Although 4227, 4198, 4895, 4350 and 4831 are numbers that occur in the Hodgdon lineup, coincidence of numbers does not imply identical performance. As was noted, both Hodgdon and Du Pont urge reloaders to use Hodgdon data for Hodgdon powders and Du Pont data for Du Pont powders.



Here's a half-dozen powders in the medium-fast category, working well in smaller rifle cases.

The three powders in Du Pont's Sporting Rifle (SR-) series are SR-7625, SR-4756 and SR-4759; again, running from fast to slow.

The Hi-Skor line now numbers two: Hi-Skor 700-X and Hi-Skor 800-X, with the latter having been introduced in early 1982.

That leaves Du Pont PB in a category all its own. Said to stand for Porous Base, it is sometimes termed PB-6, though rarely if ever by Du Pont.

Interpolating from published data, it appears the ranking by burning speed, fast to slow, of the non-IMR powders runs about like this: Hi-Skor 700-X, PB, SR-7625, SR-4756, Hi-Skor 800-X and SR-4759, followed by IMR-4227 and the rest.

Nearly all of the Du Pont powders are of the single-base type, meaning they contain no nitroglycerine. Hi-Skor 700-X is a double-base and the odds seem favorable that Hi-Skor 800-X is, likewise, although it is hard to get company spokespersons to commit themselves on that point.

Current editions of the Du Pont *Handloader's Guide* are supposed to be obtainable from dealers who handle Du Pont powders. The maker prefers not to receive requests for copies from individual reloaders.

NORMA POWDERS

Imported from Sweden, the Norma powders have been rather spottily available in this country over the past several years and have been offered in a number of different grades and designations, many of which were withdrawn at later dates.

Designations for rifle powders have included N200, N201, N202, N203, N204 and N205; not all of which have been available in the USA. Burning rates range from fast to slow in the usual custom.

N205 was an ultra-slow pusher for heavy loads and hard duty, capable of feats hardly within the reach of any other powder. It was in great demand, but in short supply. Its latter-day successor is Norma Magnum Rifle Powder, usually abbreviated as MRP. You may — or again, may not — be able to find containers of MRP at your local dealer's for sale at retail.

Along with those, over the years, Norma introduced various propellants in the burning range suitable for handguns. Most would be marketed with the slightly chilling note they were "Red Dot Equivalent," or perhaps "2400 Equivalent."

Amigos y amigas: NO powder is equivalent to any other

powder. Comparable? Possibly. Equivalent? *Mais non. Nyet.* The English No and, after that, the Spanish *No*. Equivalent means equal to sixteen decimals or so. On that icy basis, one lot of any given powder is not even equivalent to any other lot of the same powder. They may offer performance within acceptable limitations, which gets them accepted for canister sale to the reloading trade, but there are minor variations and departures.

I suggest you be rather skeptical concerning any powder that is marketed as the equivalent of whatever-whatsit other powder. In cold fact, that isn't quite the way the system works.

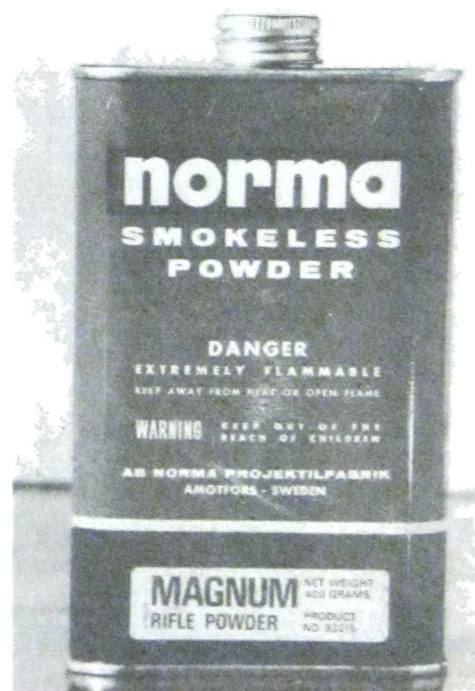
OTHER POWDERS

Herter's once had a line of powders for rifles, shotshells and the like. In other areas of the world, the Nobel powders may be just about the only game in town.

Out in the shop, I have part of a coffee can full of pale gray flakes that were bestowed upon me many years ago by a benefactor whose identity is long since forgotten. The only information accompanying it was that it was called H-066.

That fateful coincidence of numerals, again: Was it usable with data for Du Pont's P-5066 of years long gone? Well, as it turned out, it wasn't. Inquiry among knowledgeable sources revealed that it was compounded for specialized use in shooting oil wells. It contained some substantial percentage of RDX, a fairly right-now explosive, as contrasted to the pushers and shovers that are useful to reloaders.

I never tried making up a cartridge with the donated H-066 and I was glad of that when I got the word. Merely because it *looks* like smokeless powder, which this stuff does, doesn't necessarily mean you can employ it to power reloads with safety, savoir faire and gratifying results.



Norma powders, such as MRP, are being imported from Sweden again, currently by Outdoor Sports Headquarters in Dayton, Ohio, and should be available.

THE RIGHT BULLET FOR THE JOB



Not only do you want the right bullet for the job at hand, but it's of highly vital importance to have the right cartridge for the given rifle you plan to fire!

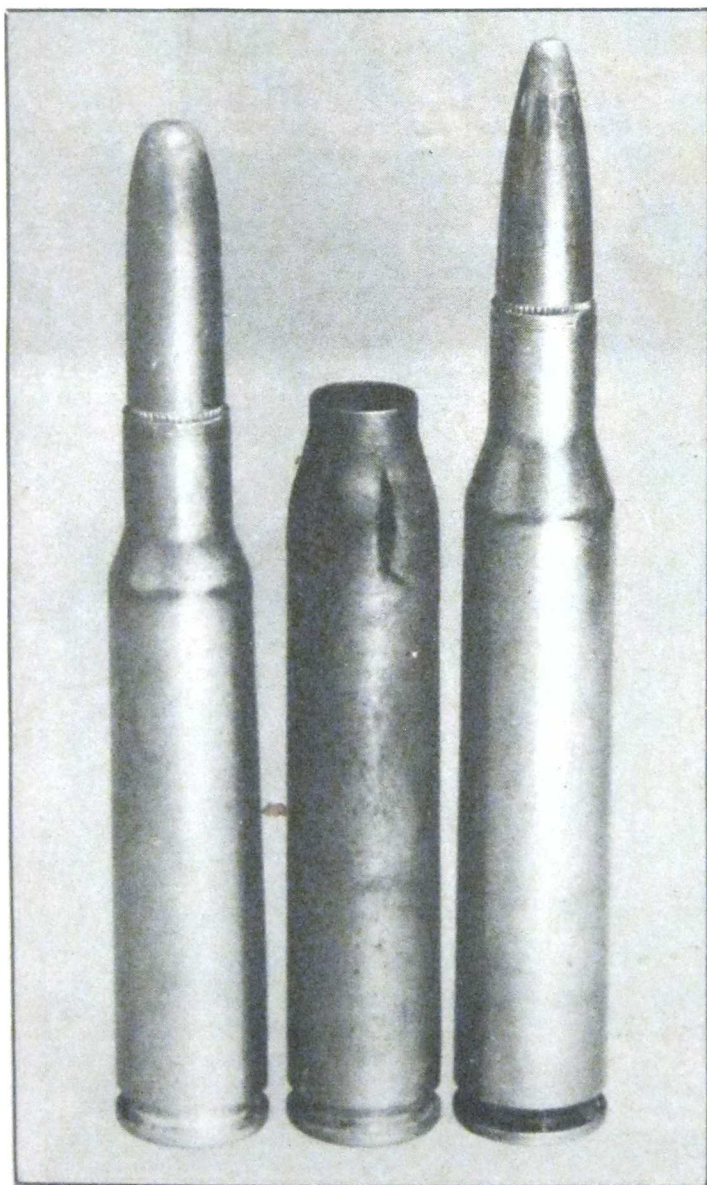
Given The Requisite Diameter And Perhaps The Gross Weight, There Are Still A Lot Of Factors To Juggle And Reconcile For The Just-Right Effect

ONCE THE projectile leaves the muzzle, it's strictly on its own. Literally as well as figuratively speaking, you've shot your wad and it's all on the line; entirely up to the swiftly departing goblet of lead and perhaps copper alloy, whether it impacts against the target or not in the first place and, assuming it does, whether it accomplishes the effect you had in mind.

If you're firing at a paper target, accuracy — the ability to cut tight little groups, right on top of the desired point of impact — is nearly always the paramount concern. Penetration? Yes, it's pretty certain to get through the paper with no trouble. Expansion? Hardly likely at all, and no great

asset if it did. Of course, it's nice if it cuts a big, sharp-edged hole in the paper, so as to get just a trifle closer to the inner scoring rings, perhaps to cut the line and gain an extra point. That's why the wadcutter bullet design is so popular among target shooters, or the semi-wadcutter that also produces a fairly clean hole in the paper of full bullet diameter.

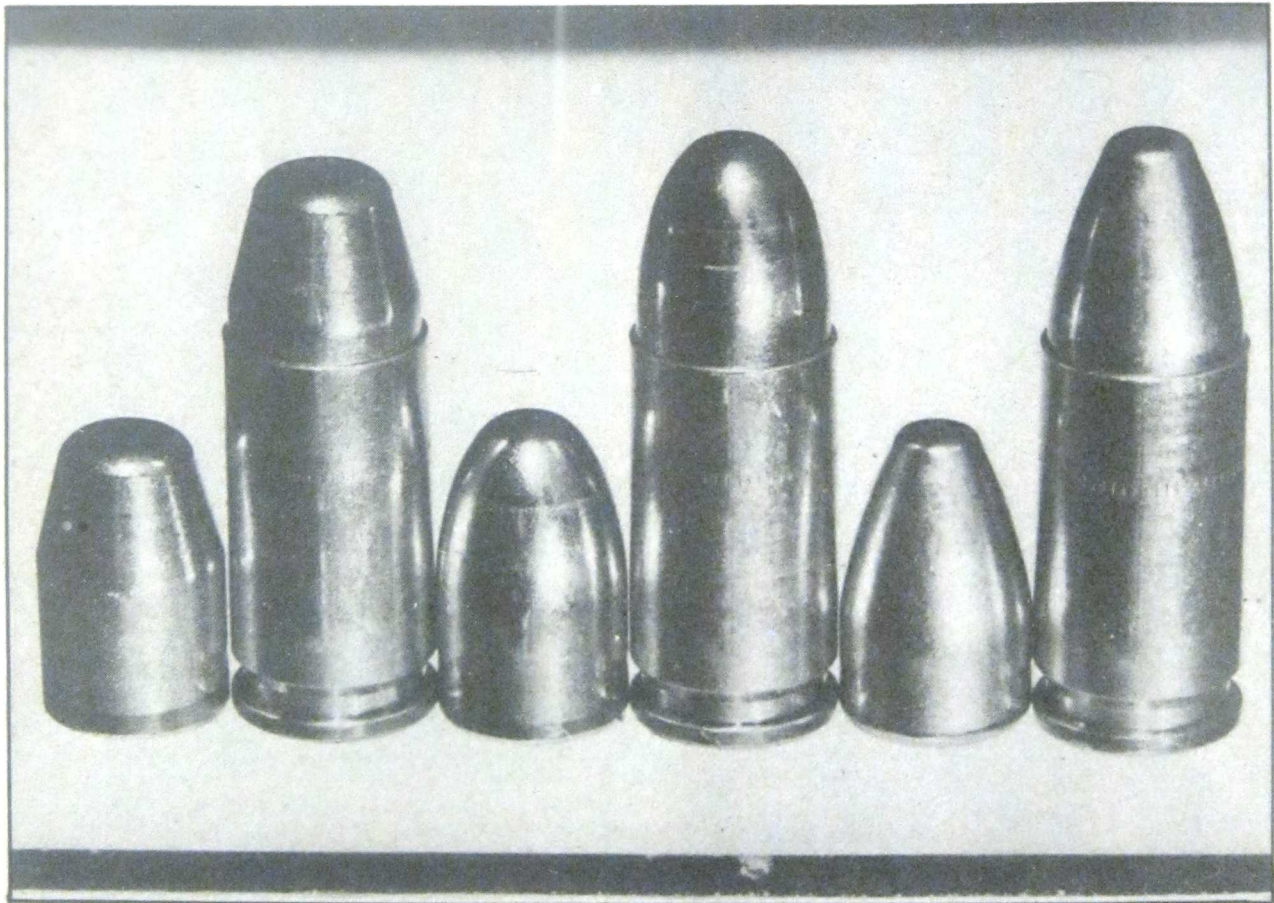
Curiously enough, with all that in mind, an awful lot of jacketed hollow point (JHP) bullets get fired at paper targets and this tends to puzzle the casual layperson. Why use a hollow point (dum dum!!) bullet, when it can't and won't expand? It's a logical question if you don't know the answer: For some curious reason, hollow points tend to be



Here's a better overall view of that case on the facing page. I'd bought an old rifle from a local pawnshop, ostensibly in caliber 7x57mm Mauser; the cartridge at left, here. After firing a round of 7mm, the case emerged looking as the center one does. After a careful check, it turned out that someone had made a conversion to .270 Winchester — the cartridge at right, here. In firing the 7mm, I had swaged its .284-inch bullet down to .277-inch in a frightful hurry. Let this be a lesson to you and to me, too!



Above: The two bullets at left are for the .45 ACP, usable in .45 revolvers, as well. Exposed lead at tip of left bullet may cause resistance to feed in some autos, though it's no problem with revolvers. Bullet at right is a cast semi-wadcutter, with gas check. Lyman #358156, my personal choice for the .357 magnum.
Below: Three examples of FMJ bullets for the 9mm Luger, in and out of loaded rounds. From left, Hornady's 124-grain flat point or Air Force design; Sierra's recently introduced 130-grain round nose; and Speer's 125-grain tip call it what you wish. Jacket of the Speer bullet is electroplated, covers core all around.



gloriously stable in flight and, as a result, they're more apt to turn in the sort of group you had in hopeful mind than any of the other designs. That is more true of the JHP than of the hollow point bullet of unprotected lead, but even the latter usually are among the better performers.

Jacketed soft points (JSPs), at their best, tend to be right about up there with the JHPs and usually out-perform the full metal jacket (FMJ) designs by a substantial margin.

That portion of the nose which is of less than full bullet diameter is termed the *ogive* (OH-jive) and it comes in several different shapes or profiles. The classic *spitzer* design is simply an arc of a circle having a radius equal to some given number of bullet diameters. Its center is some distance ahead of the bullet base. The *spire* point is more or less a straight line from full-diameter to the radius at the bullet tip. A variant of that is the *secant ogive* used by Hornady; a rather sensuously curved offshoot of the basic spire.

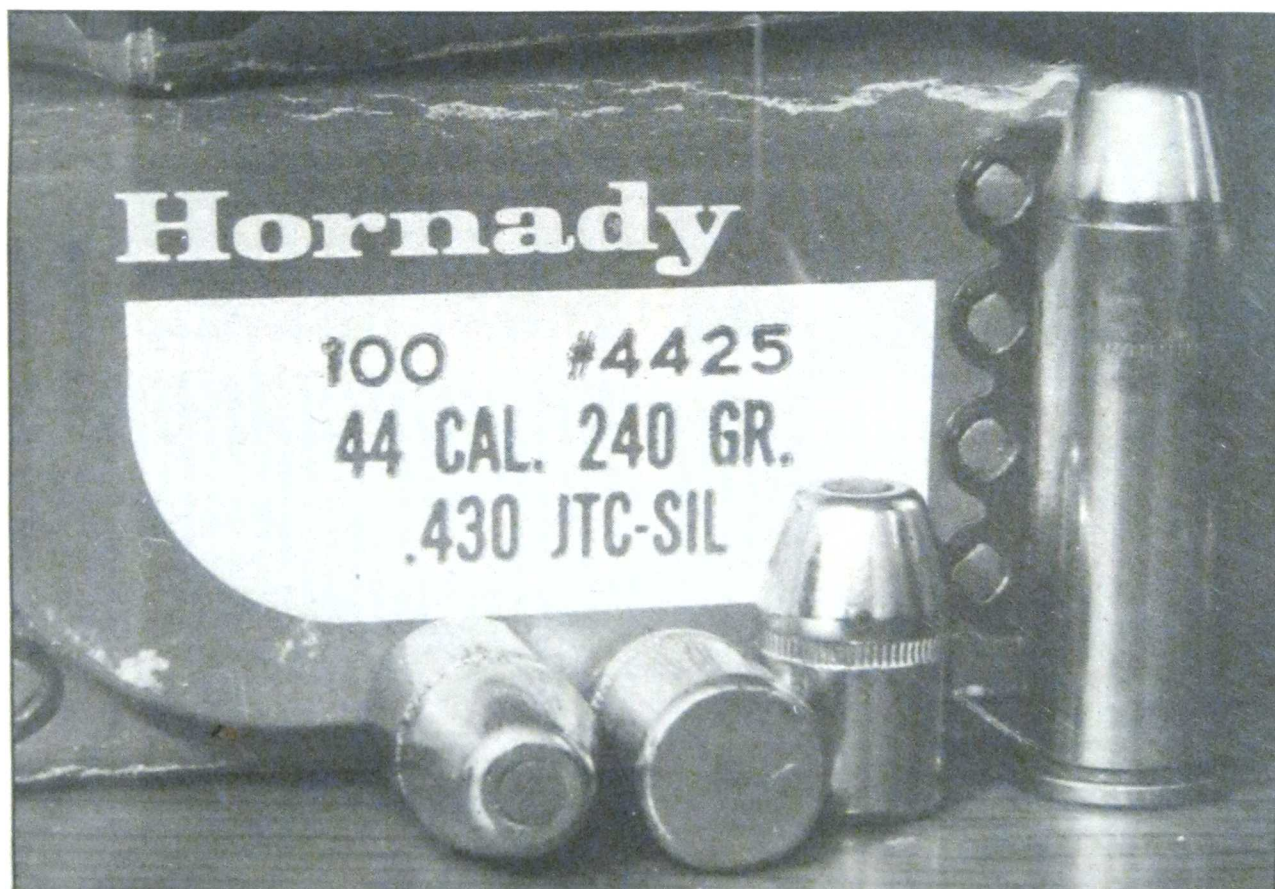
Then we have the round nose (RN), the pointed semi-point (PSP), the truncated cone (TC) and other less common varieties. One purveyor of bullets, now out of business, came up with a bullet whose profile put one in mind of a Coca-Cola bottle and made glowing claims about its virtues in the florid prose style for which their catalogs were noted. Whether or not that one worked as advertised, I really can't say, having never managed to get my hands upon any.

The inherent ability of a bullet to fly point-foremost in a nearly straight line is due to the gyroscopic effect of its rapid rotation. Theoretically, any given bullet has an optimum rotational speed in revolutions per second (rps) and does its best work if spun at that rate or as close to it as possible. Above or below that rate, it is either overstabilized or understabilized and its accuracy potential deteriorates to some extent, either way.

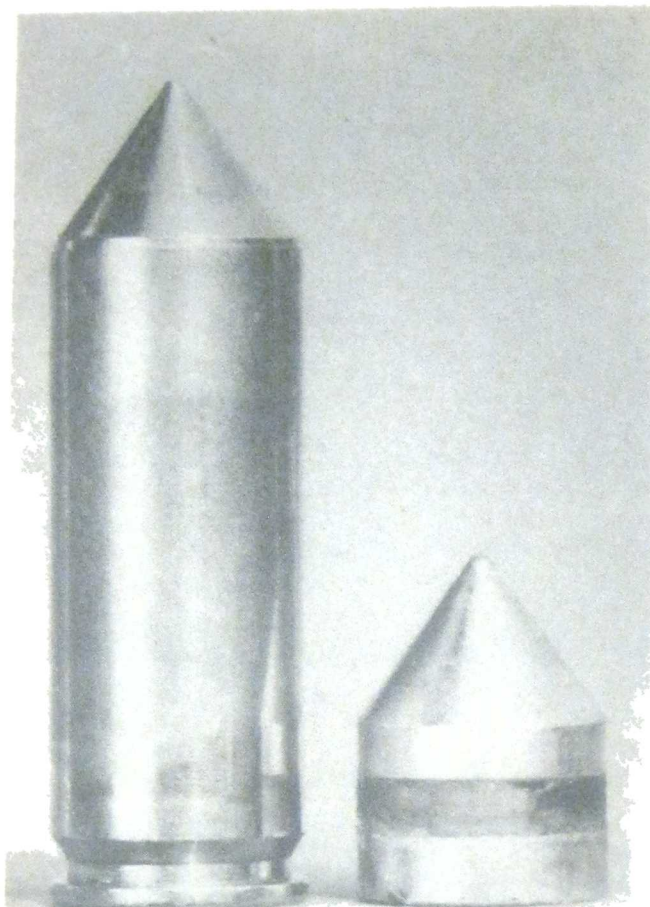
Curiously enough, a bullet loses its spin much more slowly than it sheds its forward velocity. Since the centrifugal force of the spin is a key factor in its ability to expand upon impact, you can see why it is not valid to make up some loads at reduced velocities for testing of expansion at extended distances. It just doesn't work that way in the Real World.

I wish I could pass along a simple formula by means of which you could readily determine the ideal rate of rps for any and every bullet ever made, going on to determine the ideal velocity in terms of the rifling pitch of the barrel at hand. Yes, I'd like to have that information on tap for my own use, too.

I can offer but a few possibly helpful generalities, based upon my own observations and experience. If a spitzer bullet is marginally understabilized and slightly erratic in flight, its round nose counterpart of the same weight will (nearly always) turn in better groups. That suggests the optimum spin could be a function of the length of the bullet



Developed for maximum knockdown effect on the 200-meter rams in silhouette competition, Hornady's JTC-SIL bullets have a small dab of exposed lead at the tip, but will hardly ever expand appreciably on impact. That makes them an interesting possible choice for hunting, if you desire maximum penetration.



This is the Hensley & Gibbs #938 cast bullet in caliber .45 size, here loaded in a .45 Win. mag case, but usable in .45 ACP, as well. It feeds reliably in most autos, usually groups well and, as you'd rightly assume, penetrates fiercely.

axis in ratio to its cross-sectional area and sectional density. The greater the axial length, the more rapid the rate of spin required; other conditions equal.

Conversely if the spitzer or spire point bullet is at or slightly beyond the point of being overstabilized (too much spin), changing to a round nose bullet of the same weight is apt to produce groups of three or four times the spread, perhaps more. The same effects apply and the round nose ends up grossly overstabilized, responding accordingly.

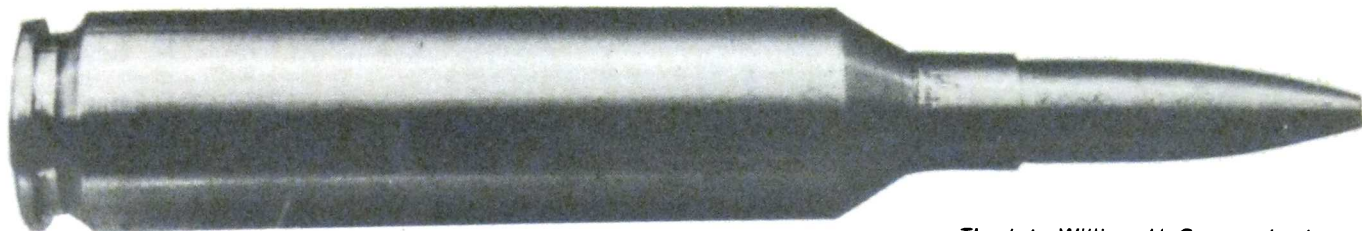
Some manufacturers offer bullets made up with extra-thin jackets for reliable expansion at the modest velocities obtainable with the smaller cartridges such as the .22 Hornet or .30-30 WCF. If you put, for example, a thin-jacketed Hornet bullet in a .22-250 Remington or .220 Swift and sizzle it forth at maximum available velocities, you may — given proper light conditions — see a thin gray rope of smoke in the air as it disintegrates from atmospheric friction, like a tiny meteorite. In less aggravated conditions, an overdriven JSP may leave a hole in the target with a small comma-shaped smear of lead particles tangent to the hole, somewhat like a stylized comet's tail.

Considerations of accuracy aside for the moment, the round nose JSP bullets usually expand and perform better on thin-skinned game than do the spitzer or spire point JSPs. The reason is obvious: They put more frontal area in contact with the medium at the instant of first encounter and thus expand more rapidly. It is not unheard of for a spitzer JHP to zip clean through game such as a whitetail deer without expanding in the slightest, particularly if the velocity is not overly great.

It needs emphasizing, over and over again, that one should never use bullets in cartridges for use in rifles having tubular magazines if the bullet tip is pointed or even rounded. The reason should be obvious: Under the effect of recoil, the primer of the first cartridge in the tubular magazine is brought into violent contact with the tip of the bullet in the next cartridge and so on, down the line. If any one primer should fire, it will set off a chain detonation of the rest of the cartridges in the magazine.

Here's the Speer 150-grain caliber .30 bullet with a flat point for use in the .30-30 WCF. As discussed here, it is capable of high expansion in the .30/06; sometimes too much of that!





The late William H. Corson had a logical idea that the .235-inch bullet diameter had possibilities. Here's one in a wildcat on the .284 Winchester. Roughly midway between the .22s and .243s, it remains unappreciated to the present.

Thus, most makers offer flat nose JSPs or JHPs for use in the .30-30 WCF and similar cartridges typically used in rifles having tubular magazines. Usually, the caliber .30 versions are in weights of 125 to 170 grains or so and these can be used to really excellent effect in other caliber .30 rifle cartridges if you feel the need for exceptionally high rates of expansion upon impact.

These days, with megabuck damage suits so much the fad, it is a rare thing for me to make up reloads for use by others. Three decades or so ago, I wasn't as wary. One of my furnace customers announced he'd like me to make up some .30/06 loads for him to take deer hunting and, next time through, three weeks later, I laid off twenty rounds carrying the Speer 150-grain flat nose JSP nominally made for the .30-30 WCF, backed by enough Hi-Vel #2 powder to boot them forth at just over 3000 feet per second (fps) at the muzzle. It was a sanctioned load in the Speer Manual of the era, although a maximum listing. Anymore, I'd never dream of starting at the max' load if someone else were going to fire it (or even if I were!) but, as noted, that was long ago.

Three weeks went past and I stopped to see my dealer again. About the first thing he did was to transfix me with a peculiar stare and say, "We fired off four of those cartridges of yours."

"How did they work?" I asked.

"We got a deer," he said, adding, "and three black bears."

The details remained reasonably fresh in mind as the years came and went. By the late Sixties, I was the resident reloading guru at *Gun World* and my friend and employer, Jack Lewis, was scheduled to go off in pursuit of a hunting story for the magazine. He was packing a .30/06 and prevailed upon me to make him up some special cartridges.

"If I hit 'em," he told me, "I want 'em to go down!"

I adjourned to the bench and put up some more of the good little 150-grain Speer flat noses. Hi-Vel #2 was off the market, but I still had some (still do today, in fact!) and disbursed enough of it to compound some of about the same loads for the Cautious Cowboy, as he's sometimes known.

The one detail I can't recall is the exact game species that was his quarry at the time. I suspect it may have been a mountain lion, prized for the elegance of its regal pelt, when taxidermed into a throw rug.

Lewis returned from safari and sought me out to deliver a soulful look.

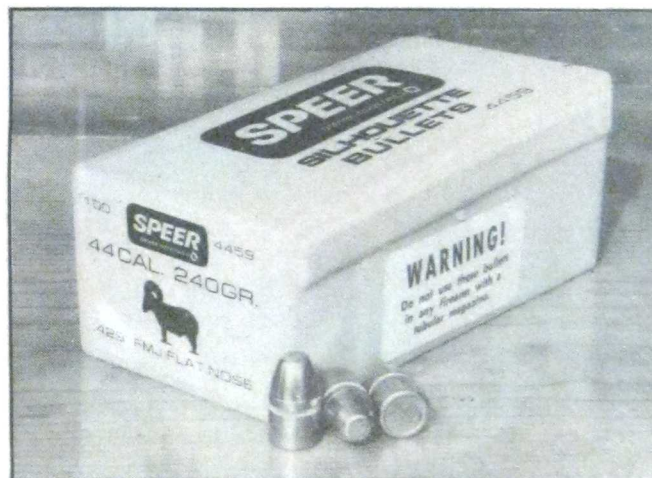
"It didn't put 'em down?" I speculated.

"Oh, it put 'em down, all right. That wasn't the problem," he explained. "The problem was, there wasn't anything left worth picking up!"

And that was only the next load down from the top, in the old Speer Manual...

Thus, we see it behooves one to contemplate just exactly how hard one proposes to shoot the intended quarry. There is definitely such a thing as getting carried away with a surfeit of enthusiasm.

Handguns, as well as rifles, may and often do pose some amount of problems in arriving at the pluperfect rate of spin. One of the more obvious examples is the 148-grain



Above: Speer's #4459 is another in their series of FMJ designs with the jackets applied by means of electroplating. (Below) The Alberts #2905 is a hollow base wadcutter design for .32 S&W or the more recently introduced .32 H&R magnum.





The Lyman #356402 mould produces this truncated cone cast bullet for use in 9mm Luger, .38 Colt Super and other cartridges requiring the .356-inch bullet diameters.

wadcutter bullet for the .38 Special cartridge. The Smith & Wesson works, for reasons they've never revealed to me, rifle their .38 Special revolver barrels at a pitch of one turn in $18\frac{3}{4}$ inches, or 1:18.75, as usually written. Wadcutter bullets in the .38 Special are pretty much always loaded to rather diffident, mid-range velocities in the 790 to 820 fps ballpark. With the 1:18.75 rifling, that usually does not impart enough spin to deliver the sort of groups wanted. In fact, it is fairly common for the bullets to imprint some portion of their profiles in the paper, *keyholing*, it's called.

Apropos to that, I wish I could forget a long-ago pistol match in which the shooter next to me was firing an S&W .38 Special that keyholed its wadcutters into almost perfect profiles, practically every time. What was truly infuriating was that by some subtle and arcane alchemy, it keyholed every damned one of them into the vital heart of the poor bloody X-ring! I've always wished I could figure out how he did that...

Back in the mid-Seventies, Austin F. Behlert took a nice K-38 Smith & Wesson I had at the time and rebuilt it into what I've come to call my BK-38. He installed a massive square-sided bull barrel, a Douglas Premium, with a heavy

Introduced by Sierra as a bullet for duplicating the .38 Colt Super factory load, their #8345 can also be loaded into the 9mm Luger. Sierra can supply load data on request and a SASE's appreciated.



rib topside and did other good things, as well. The barrel has a pitch of 1:14 and the effect of the faster twist upon the 148-grain wadcutter loads is hard to believe. All the holes are neat little circles, with never a visible trace of slaunch in their passage through the paper. More, given just about any decent load, it will stack all the little round holes practically one on top of each other in a manner calculated to warm the heart all the way from the right ventricle to the left cockle.

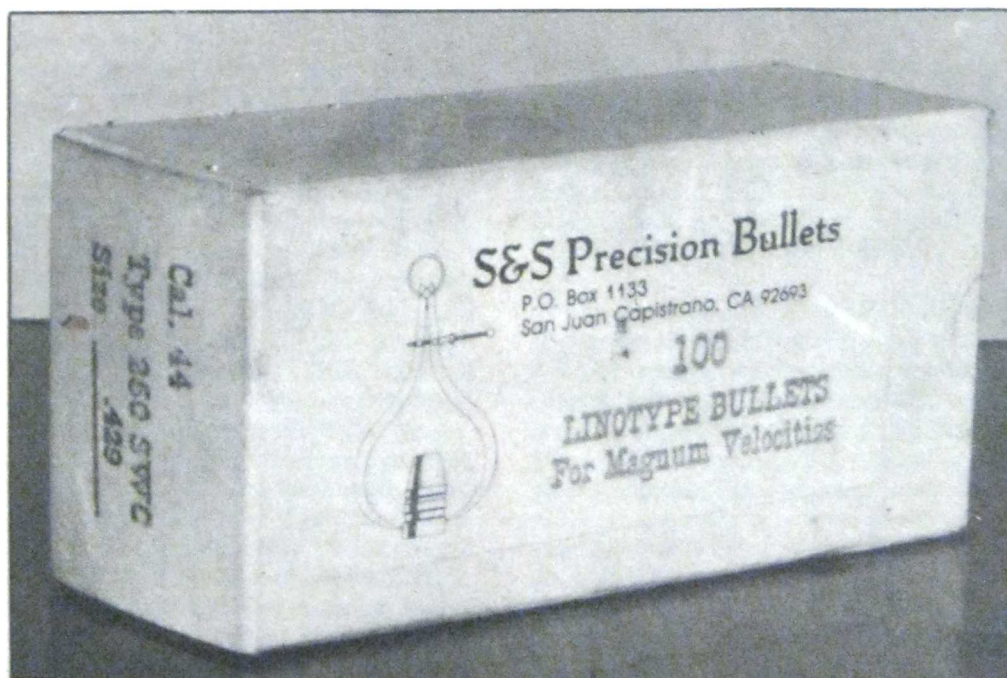
If I ever get my hands upon a time-traveling machine, one of my first projects will be to return to that ancient pis-

tol match with the BK-38 and eat that rascal's lunch.

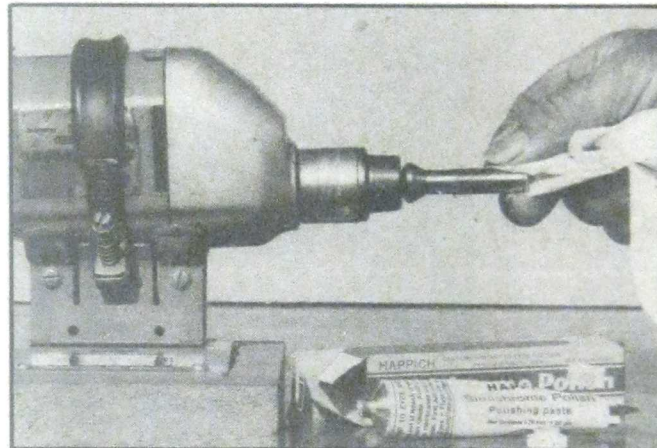
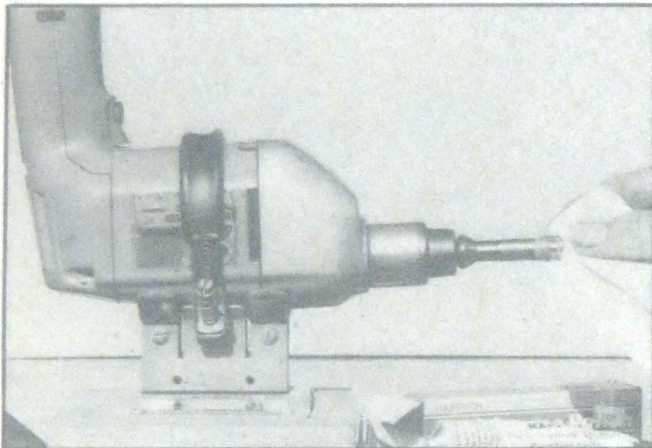
Levity to one side, there are a remarkable number of good and effective bullets available to the reloader today; much more than there were, only a few years ago. At the bottom line, there is no substitute that works a thin fraction as well as just plain trying some of each through the gun you use and letting it acquaint you with its personal preferences and prejudices; all guns have those, it seems. Try 'em all and use those that seem to work the best. On game, try to arrange it so they leave you something worth picking up and taking home.



Above: Speer provides their #1049 with a cannelure for use in the Mini-14 Ruger and other autos requiring a crimped bullet. C-H Tool & Die can supply a .223 Rem crimping die. (Below) Locally produced bullets can offer an attractive alternative to casting your own, but must be shipped to FFL holders if ordered out of state.



METALLIC CASE PREPARATION



With a .44 magnum case rotating rapidly on the end of a K-Spinner, a dab of Simichrome polish is applied to the head of it at left and wiped off with a fresh area of paper towel at right to result in a mirror-bright shine.

They May Be Brassy, But They're Seldom Cheap And Here Are Notes, Thoughts And Comments On Making Them As Good As New Again

GETTING THE SPENT brass from rifle and handgun cartridges prepped for the next cycle involves a few small checks and chores, as will be reviewed here. All of this supplements Chapter 5, but, it's to be hoped, does not repeat overmuch of it. I will say what needs to be said, mindful that some may have skipped lightly over Chapter 5.

INSPECTION & SORTING

The spent cases may be some you fired yourself, or they may be some you bought, with previous firings by gosh alone knows whom. In any event, they require careful scrutiny. Are they readily reloadable, or do some of them carry Berdan-type primers? If they are hulls from old revolvers, do any of them have the fragile balloon heads instead of the modern web heads?

If they are of the bottleneck variety, they may be over-length and require trimming before further reloading, or they may be so thickened in the neck as to need case neck reaming to assure sensible peak pressures with textbook loads. The internal space may contain foreign matter and

debris of every conceivable sort and you need to check for that. Small pebbles get into fired cases, as do the remains of bugs, spider nests and all manner of allied detritus. It's all a matter of scan, spot and rectify.

It is highly desirable that the cartridge cases be uniform in all characteristics. It is a bit of a strain to realize and accept how extravagantly they can vary from one maker of cases to another. Certain calibers are notable offenders in that regard. The 9mm Luger/Parabellum is surely one of the worst. The old .45 Colt or Long Colt is another, not to neglect the .38 Colt Super, .38 Special, .357 magnum, .44 magnum and others not here clearly specified.

Cases for the 9mm Luger vary so absurdly that you may encounter some that won't fit into the shell holder you're using; either they refuse to enter the slot, or they have so much free "slop" that they'll wrench loose under traction. Somewhat the same applies to the .45 Long Colt.

Thickness at the case neck is another key factor. In the .45 ACP, cases made by Remington — usually headstamped R-P — will be quite thin in the neck. Your regular reloading dies that do a fine job with most cases may not be



At left is one authentic example of (Good grief!) a .45 ACP case that carries a Berdan-type primer that will cost you a decapping pin if not spotted.



Happich's Simichrome and the more recently introduced Flitz are two exceptionally effective compounds for cleaning and polishing nearly any metal, including the brass used for production of center-fire cartridge cases.

able to put enough of a grip on R-P brass to hold the bullet base with the needed degree of tenacity. There are various solutions to the problem. You can press them up into a sizing die for the .308 Winchester case, suitably lubricated of course, to get them tapered down small enough so a pass over the expander die will do a suitable job. You can get a special resizing die dimensioned to handle R-P brass from the more thoughtful makers such as Lee Precision, or you can sort them out and convert them all to .41 Avenger cases if you happen to have a barrel to handle that doughty cartridge. They also make pretty fair .38-45 Clerke cases.

Bafflingly enough, the situation is a total reverse when we drop down to the entirely admirable .38 Colt Super round. In that, the R-P brass has a nice thick neck that's a delight to reload. There, it's the Winchester-Western (W-W) brass that has the thin necks that require corrective measures. For a short time, the old Shelbyville, Indiana, operation of Super Vel produced .38 Colt Super ammo and they must've bought their brass from W-W because it has the same thin necks.

Since 1969 or so, when I first got involved with the .38

Colt Super cartridge, I've had a tungsten carbide resizing die from Lyman that handles the R-P brass to total perfection, but it turns out dubious loads with the W-W cases. Fairly recently, I've gotten another t-c die from RCBS that does a good job on the W-W and Super Vel cases. If you use the latter on the R-P cases, you get a cartridge that is somewhat wasp-waisted and faintly painful to contemplate.

I mentioned using .308 Winchester dies to squeeze down the necks of R-P cases in .45 ACP and a similar stratagem can be employed to cope with W-W .38 Super brass if your die is geared to R-P brass. What you do is install a 9mm Luger sizing die, adjusting it suitably and give the W-W cases a judicious pass up into the 9mm die. If the 9mm die is of the t-c type, you needn't lube the cases, but you must lube them if it's of the standard hardened steel variety. With a bit of trial-and-error adjustment, you can coax the W-W cases into getting a good, solid grip on the bullet bases.

You're right: We're getting down into the RST's of Reloading and I hope the net effect is not to turn you off of

further pursuit of the reloading Muse. I agree that it's slightly silly that one must maintain two different resizing dies in order to cope with the various cases headstamped for one nominal caliber. That is, however, the way the map flops, in some examples.

In straight-sided or lightly tapered cases for use in auto-loading pistols, you must maintain a secure grip of the case neck against the bullet base for satisfactory results. If you do not, the stresses of feeding from the magazine into the chamber may set the bullet neck in the case mouth, perhaps compressing the powder charge in so doing. If that happens, it can boost the peak pressures at the time of firing to dangerous levels and perhaps beyond those. You do not want that, correct?

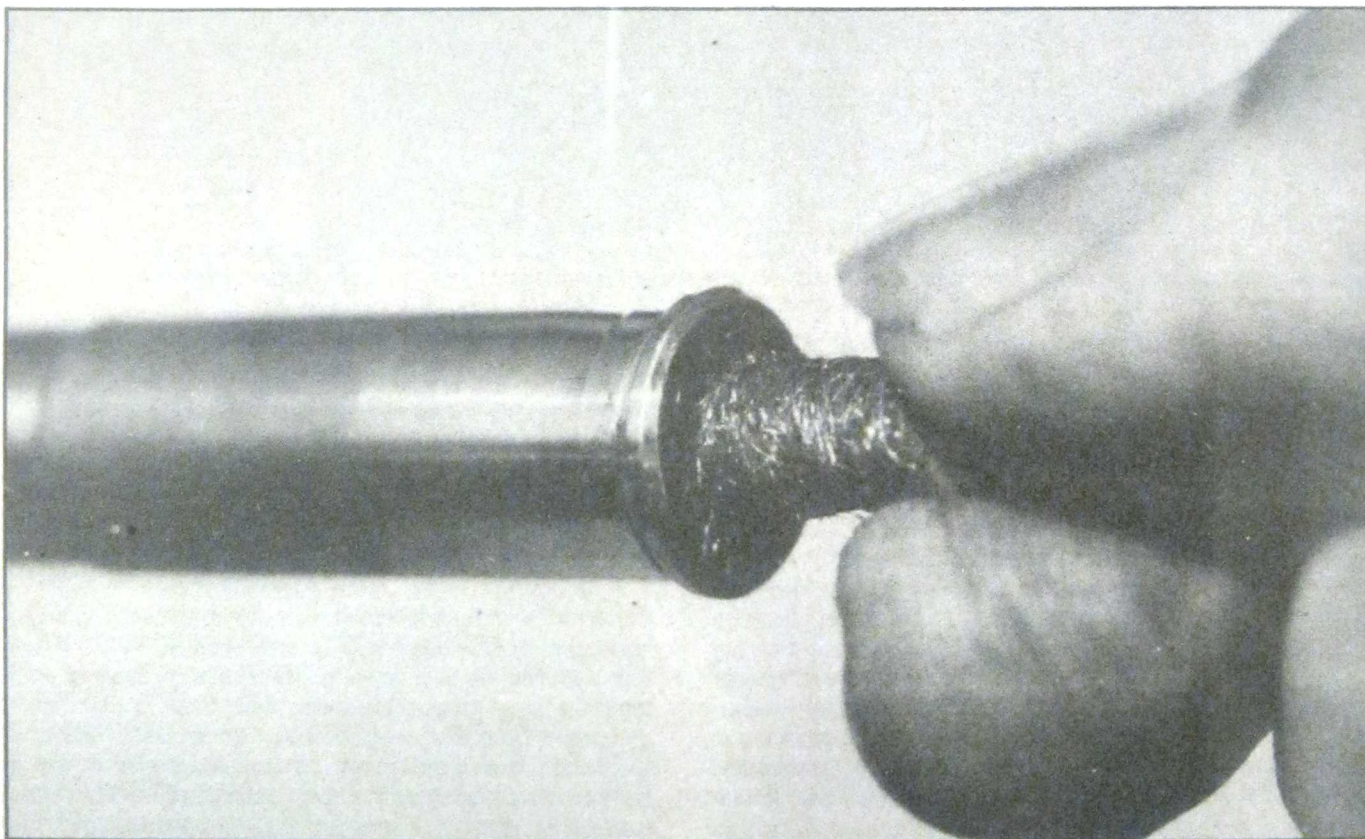
A secure grip of the bullet base is at least as important when reloading straight-sided cases for revolvers, or slightly tapered ones such as the 9mm Luger, for that matter. Yes, there are revolvers in 9mm these days, as made by Ruger or Smith & Wesson, to cite but two. I have a 9mm Model 547 S&W and have come to admire it rather intemperately.

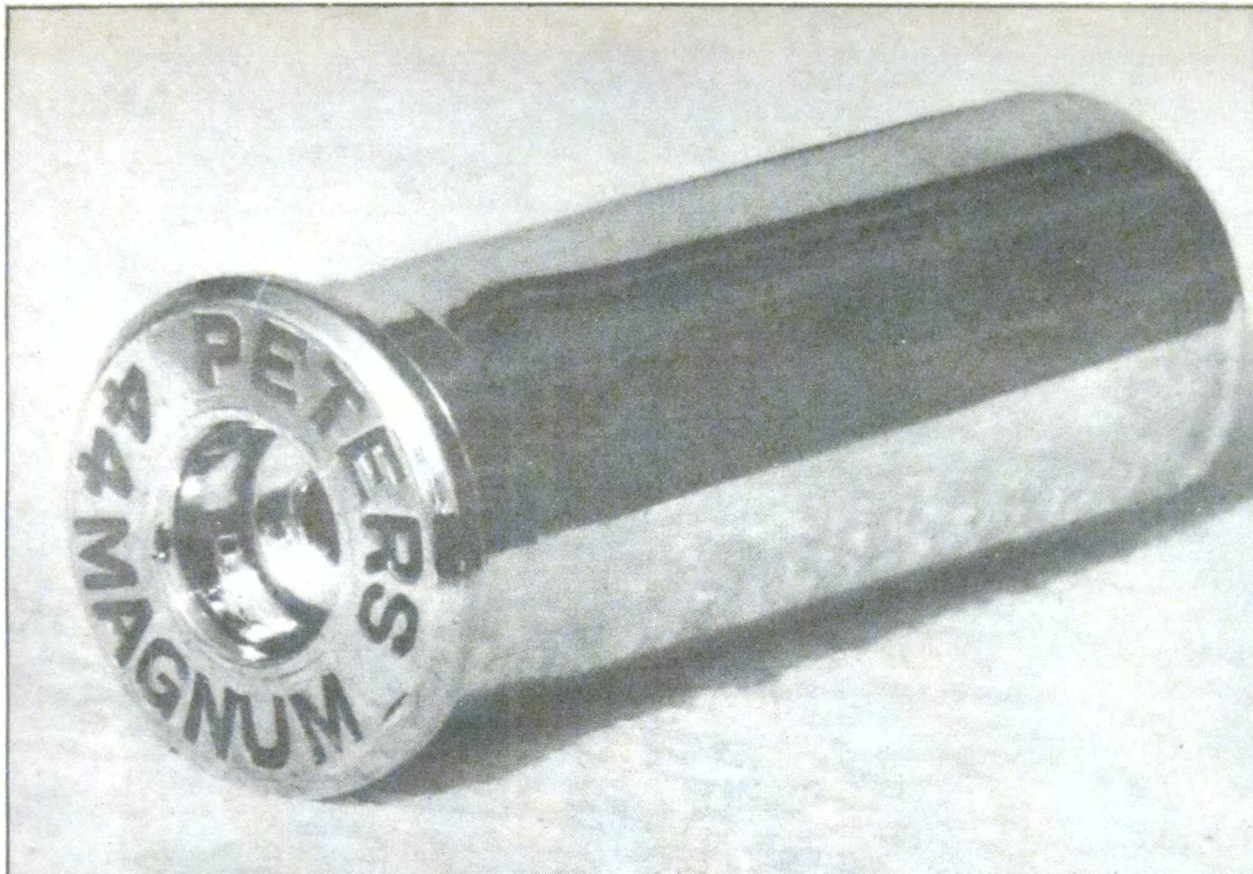
A loosely held bullet in a revolver cartridge tends to migrate forward under the stresses of recoil. It may have to endure the shocks of as many as five firings, perhaps more, before it comes under the hammer. If the bullet shifts forward a little distance each time, the tip of the bullet may project beyond the front surface of the cylinder. If that happens, it won't be able to rotate into line with the barrel when its turn comes and you have a hung-up revolver. An inoperable revolver makes a fairly good paperweight but has little or no other utility.

Furthermore, there are some of the slower-burning powders, usable in revolvers, that require some amount of frictional resistance to assure proper combustion. By that, I mean the bullet needs to resist forward motion for a brief interval before breaking loose to move up the barrel.

You will encounter several sources that decree a heavy roll crimp of the case mouth against the bullet base to hold the bullet in place against recoil migration or preliminary burning of the powder. In point of coldly demonstrable fact, a heavy roll crimp at the case mouth is of little help at all if it's not reinforced by a good frictional engagement be-

That same case that was partially polished in the lead illustrations is still spinning and we're holding a piece of wooden dowel, with a tuft of fine steel wool wound at about the end of it into the empty primer pocket; see next page.





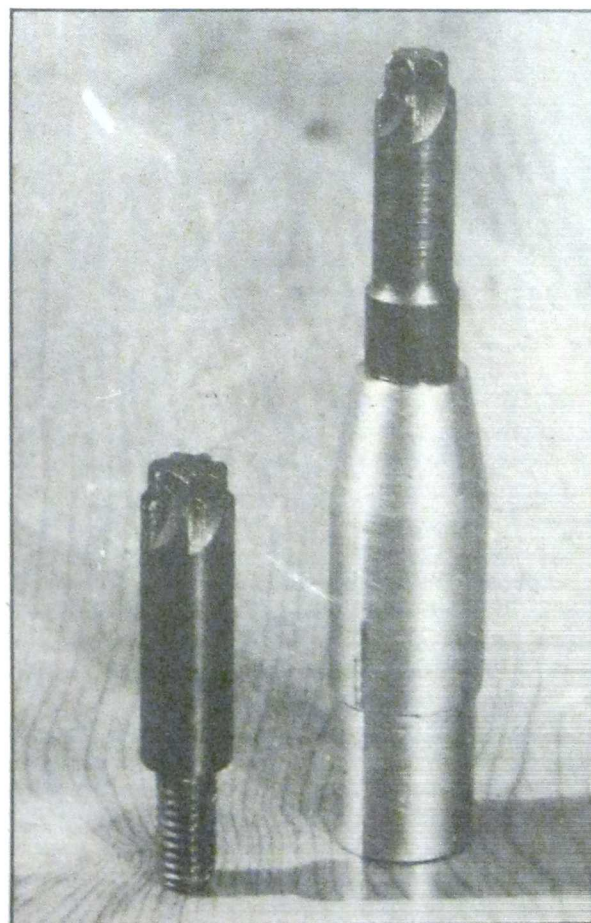
Here's the case shown on the facing page, having finally been polished full-length and the result of the applied steel wool is clearly apparent to the viewing eye. Have you ever seen a cleaner primer pocket?

tween case mouth and bullet base.

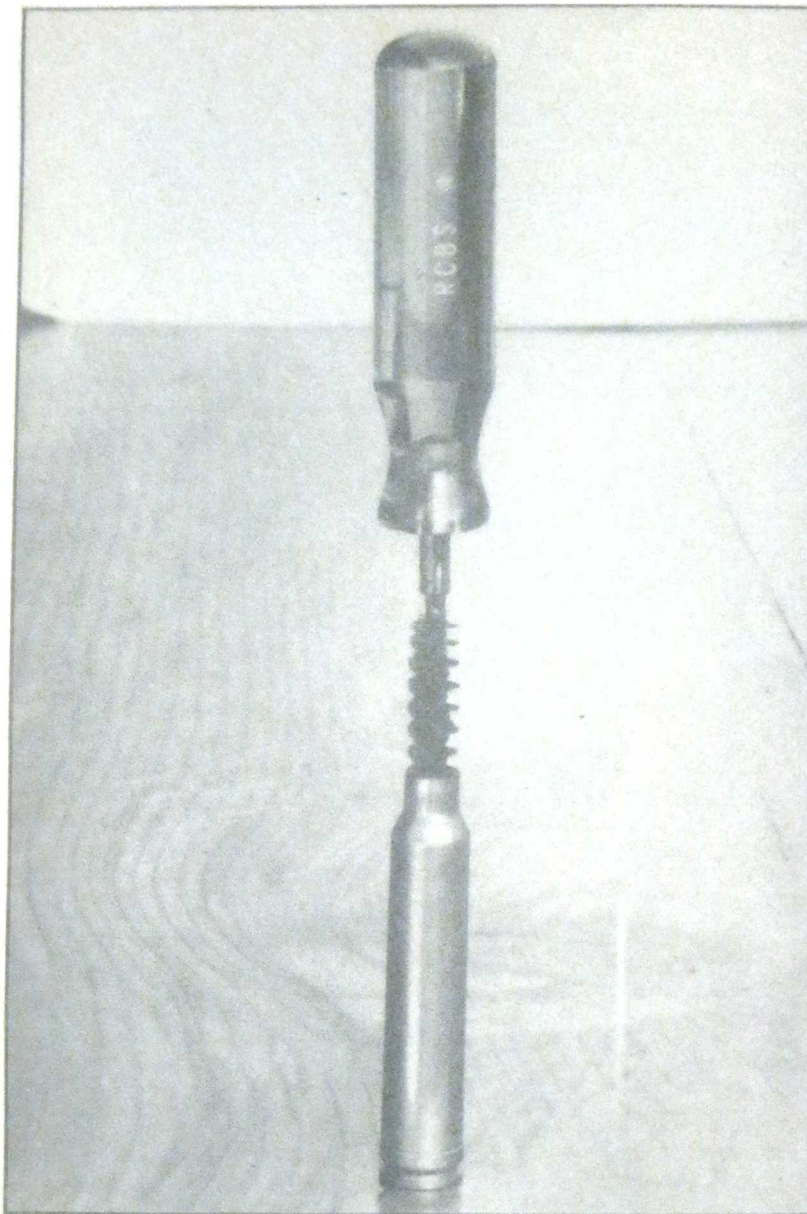
On the other hand, if you do have the needed secure grip of mouth to base, you really have little need for the roll crimp. A neat taper crimp is useful to assure easy chambering of the cartridge. Beyond that point, a roll crimp serves little or no purpose, save to gouge and mutilate the bullet base as it breaks free of the case mouth.

Whether you're reloading for revolvers or autos, there is one simple and positive method to determine how securely the bullet is held in the case mouth. It does not require expensive special equipment. All you need is a common bathroom scale or similar device, capable of measuring weight up beyond thirty pounds or so, as well as a suitable hunk of wood or similar material for exerting force against the exposed tip of the bullet, after being loaded.

Merely set the load to be tested base-down upon the platform of the scale and press downward upon the tip of the bullet with a small block of wood or whatever, meanwhile observing the indicator of the scale. While it is not a



Lyman makes these primer pocket reamers for use in their case trimmer. I fabricated the adapter at right to permit their use in a drill press at low rotating speed. When thus used, the case needs to be held securely to prevent twitching about.



Here an RCBS case neck brush in its plastic handle is being used to apply sizing lube sparingly to inside of neck.

hard-and-fast figure, you should be able to exert about thirty pounds of push upon the bullet before it commences to move on down into the case neck. Usually, you can feel it starting to move. If not, you can tell if it moved by comparing the tested cartridge to an untested one. Cartridges that will resist thirty pounds of push usually can be counted upon to perform their intended function without undue problems. In the example of smaller calibers such as the .32 S&W Long, you can be a bit more charitable and tolerant. Be mindful that the area of engaging surfaces diminishes as the bullet diameter decreases.

CASE MOUTH FLARE

After you have knocked out the dead primer, sized down the case mouth and expanded it back to a uniform diameter, it is necessary to leave the inner edges of the mouth in a condition reasonably capable of accepting the bullet base without damage to either base or mouth.

As a usual state of affairs, jacketed bullets for bottlenecked rifle cases will insinuate themselves into place with little or no problems, having a slight amount of radius around the edge that serves to coax it into place. That is not unfailingly true. One must maintain a delicate touch upon the operating handle of the press during the bullet seating operation, ever alert for unnatural resistance. With a bit of practice, you will develop an intuitive sense of the process, as communicated by the sensation of your hand upon the handle. You build up a given amount of force and then feel it start to go into place. If it doesn't happen that way and the exerted force builds to a certain point, ease off the handle pressure, withdraw the case and bullet and contemplate the situation.

If you persist in applying additional force, you will probably damage the case mouth or the bullet base, perhaps both. Bullets are expendable, by their innate nature, but the passing of a case is just cause for mourning! There is



A Forster case gauge for the .30/06 Springfield enables you to check the case for headspace at one end and for case length at the other. This gauge has seen over 25 years of use.

hardly any way to restore a crinkled case mouth to operational utility.

The tapered punches for use in a drill press, as discussed and illustrated in Chapter 4, work quite well for giving the case mouth a slight but adequate amount of flare. One approach is to install them in the drill press chuck and adjust the movable table so the punch goes into the case

mouth by about 3/32-inch after making initial contact with it, before coming to a stop. In point of fact, since writing Chapter 4, I've had reason to make up another such tapered punch and I put a small handle on that for manual use, so I don't have to keep moving over to the drill press. Set the case on the loading bench, mouth-up, insert the tip of the punch, give the top of the handle a soft slap with cupped

palm and it does a good job. I call it the Case-Neck Coaxer. As with the K-Spinner, anyone is welcome to make and market these if they feel inclined. The idea is neither new nor original. Dick Lee was making a similar mouth spreader for use on shotshells at least as early as 1960 to my certain recollection.

LYMAN'S M-DIE

The mouth-expanding plug in most die sets will expand the mouth back up to about .003-inch under bullet diameter and then you come to a fairly abrupt taper that spreads the mouth quite appreciably. Somewhere nearby should be a photo of a pair of tired old .38 Special cases whose mouths were flared not wisely but too well. You can see the one on the right cracked its mouth in the process. Excessive flaring appears the major cause of cracked case mouths and a cracked mouth is reasonable cause for deep-sixing the case. True, you can trim it back to make a .38 Short Colt case, but unless you've a driving reason to do that, it's hardly worth the bother.

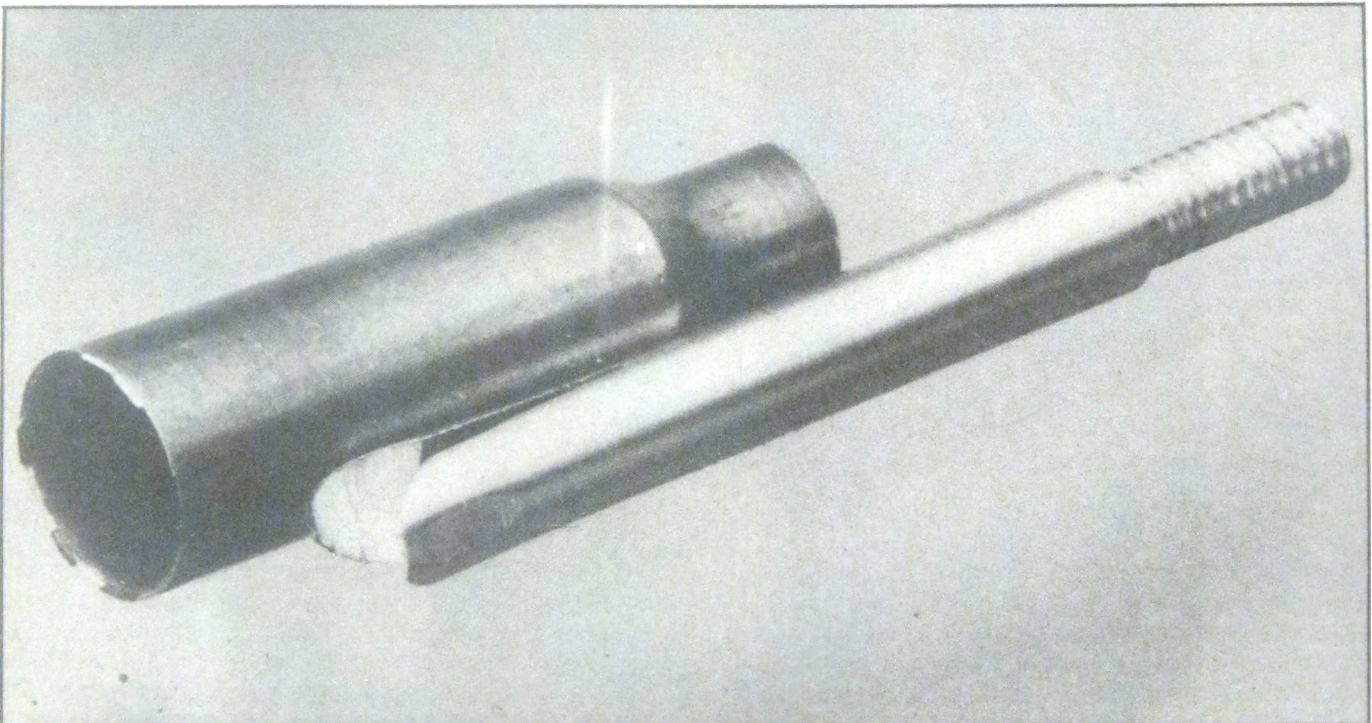
Lyman — a major producer of moulds for cast bullets — showed uncommonly enlightened self-interest in developing and marketing an expander die that does much to

assure that a bullet of lead alloy will be seated without scraping or other mutilation. At the bottom, typically, the expanding plug is about .003-inch smaller than bullet diameter. Above that is a second band which is about .001- to .0025-inch larger than bullet diameter and there is a gentle transition between the two diameters.

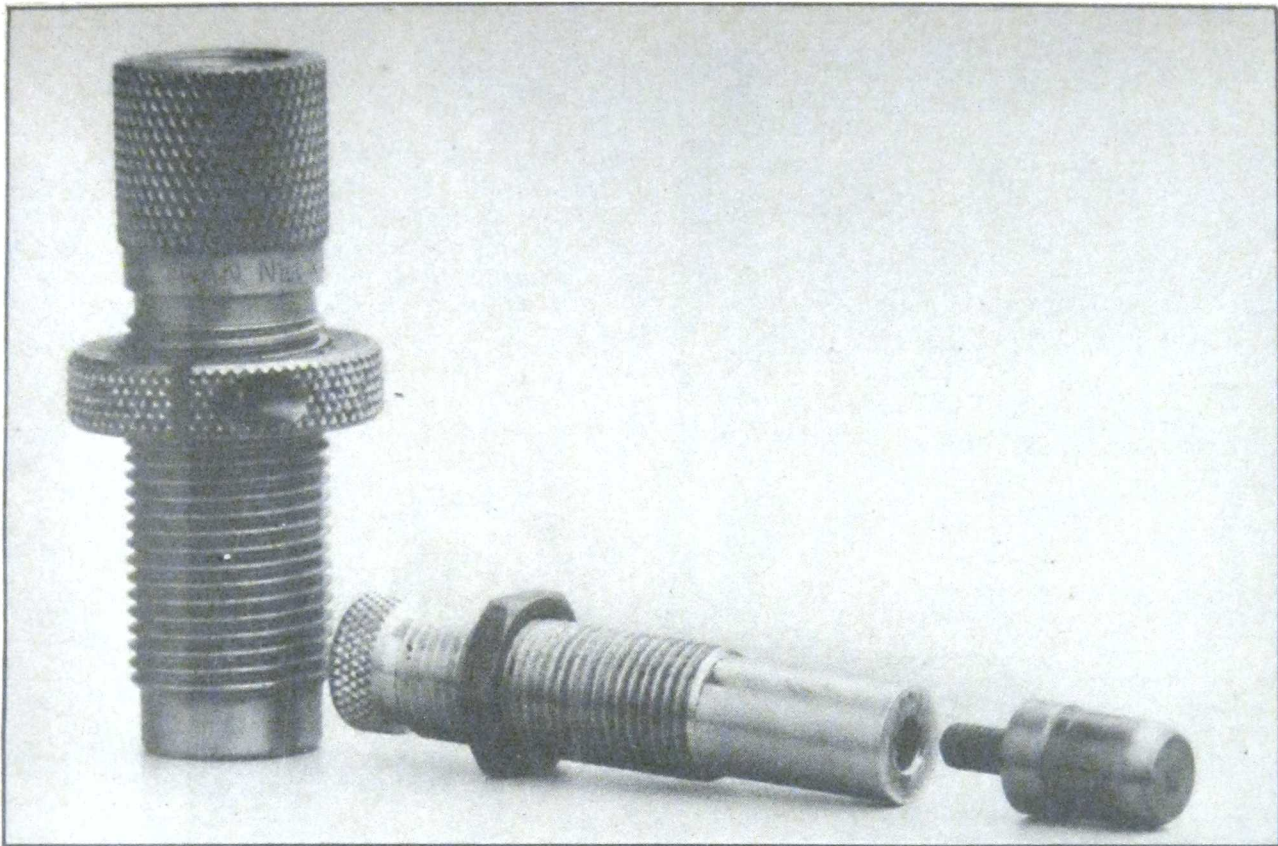
By judicious adjustment of the expander plug in the top of the reloading press, accompanied by careful checking — trying to insert the base of a bullet into the processed case neck — you can get the Lyman M-Die to the point where the bullet base will enter the case neck for just a short distance before coming up against the portion of the neck that is still .003-inch or so smaller than bullet diameter.

When the bullet is seated in a case neck processed in that manner, no metal will be scraped off the bullet sides, but it will be held in place with all the necessary tenacity anyone might desire. Such reloads tend to perform at whatever optimum the bullet design and composition, as well as the powder charge, can accomplish. It is not the sovereign solution to one-hole groups, but it is the best way I've found to date to get a cast bullet seated properly.

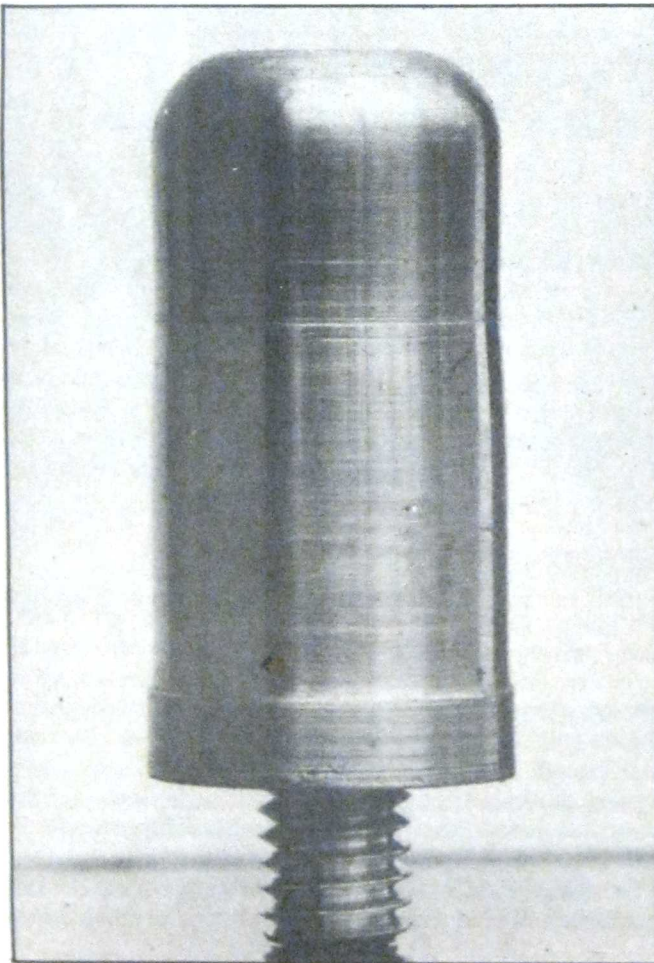
The main holding stem of the Lyman M-Die has a 9/16-18 thread and the little spud at the end that does the



Here's the front end of a separated case, a .223 Remington to be precise. Having little taper, such things can be jocosely termed hardship cases since they are absolute buggers to get out. Many years ago, I earned a lot of experience in dealing with separated cases when operating a pair of Model 43 Winchester in .218 Bee and .22 Hornet. The Bee cases, being well tapered, came out easily; the Hornets less easily. As the M43 was a bolt-action, I just took a length of 3/16" brass welding rod, sawed one end, pried the halves apart and filed them to about the pattern shown here. In this particular case/instance, the rifle was a Ruger Ranch Rifle and one couldn't remove the bolt and poke the plain end of the rod up where it could be grabbed at the muzzle and used to shove the case free. The thread at the front is 8-32, to fit the socket of a cleaning rod and it was successful also, obviously! Merely insert the cleaning rod from the muzzle, thread the jag into it, pull it up, push it back and that does it.



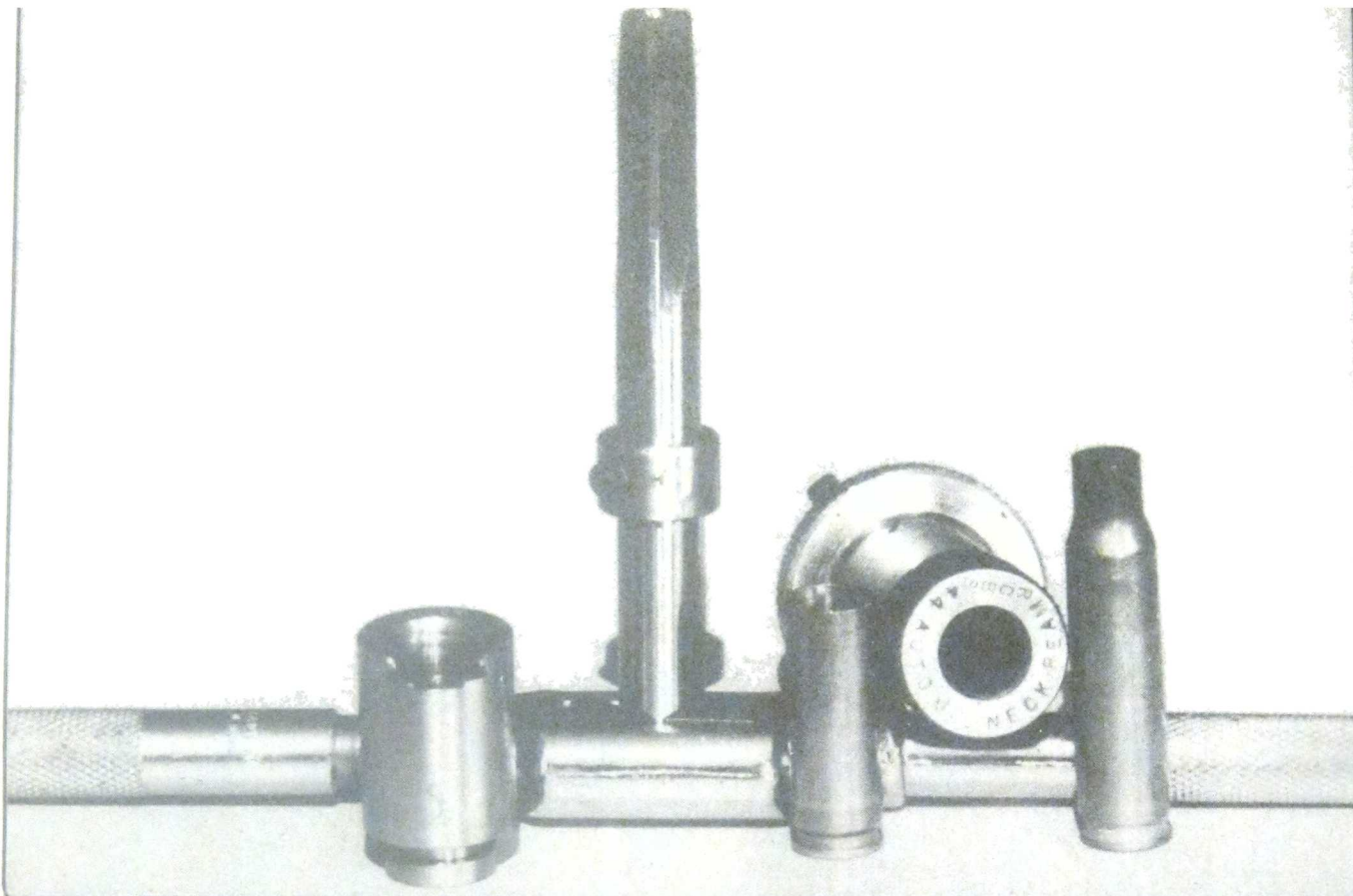
The utterly admirable Lyman M neck-expanding die, together with one of my homemade plugs for use in it and a closer view of the plug at left.



actual work is held in place by a 10-32 thread. Given access to a metal lathe and marginal expertise in the use of it, that makes it a fairly simple matter to make up your own M-type expanding plugs. Form the business end first, cut it free of the parent bar stock, reverse it in the headstock and face it off true, put a suitable size of countersink in the tailstock chuck to start the hole, replace that with a #21 drill bit and bore in for half an inch or so.

Blow the chips and swarf out of the drilled hole. If you don't have compressed air in your shop, a can of Dust-Off from the local photo store works nearly as well. Disengage the lathe drive and put a #10-32 tap in the tailstock chuck, applying a bit of Brownell's Flute Juice or Tap-Free to the tap and the drilled hole. Leaving the tailstock unlocked, move the tip of the tap into the hole and manually rotate the lathe headstock through about three or four turns, reversing it every one-third turn to break the chips loose.

With that done, loosen the tailstock chuck, withdrawing it to leave the tap precisely centered in the #21 hole in the end of the expander plug. Loosen it from the headstock chuck, attach a tap wrench to the square shank of the tap and take it over to clamp the plug in the bench vise. It helps if the vise jaws are carrying the pair of brass angles available from Brownell's. Secure the expander plug in the bench vise, apply a bit more of the tapping fluid of your choice and complete the tapping.



Examples of the custom tooling available from RCBS for sophisticated conversion of cases into some other caliber. In this example, we're making .44 Auto Mag Pistol (AMP) cases from .308 Winchester brass. The shell holder extension shoves the case up into a file/trim die (not shown) and, once cut off, it's run into the neck-ream die and inside-reamed to remove the unwanted excess of brass. The tap wrench is not supplied.

Again, blow out the chips and swarf, use some RIG 2 degreaser to remove the tapping compound. Cut a short piece of #10-32 threaded rod — brass is nice, but steel is okay — truing and rounding both ends. At this point, you need to secure the threaded rod into the tailor-made plug and the best approach for that I've found to date is Loctite Stud N' Bearing sealant, available from most auto supply stores. Ooze a drop or so of the pungent-smelling red fluid into the female thread and turn the short section of threaded rod into it securely. Jam-clench a pair of 10-32 nuts to the outer exposed end and use a small Crescent wrench to snug it into place. Let the assembly cure in a fairly hot place — perhaps the family kitchen range, with the thermostat about 250 degrees Fahrenheit — for forty-five minutes or so and, extensive experience indicates that, under severe stress, you will twist off the threaded rod, but you'll never get the "glued" stub out of the tapped socket unless you drill it out.

That, *amigos y amigas*, is the approximate procedure I've developed for making up homemade tips for Lyman M-Dies to personal tastes and my sole excuse for devoting this much space to the details is that they can be made to perform with an exquisite precision far beyond your fondest dreams.

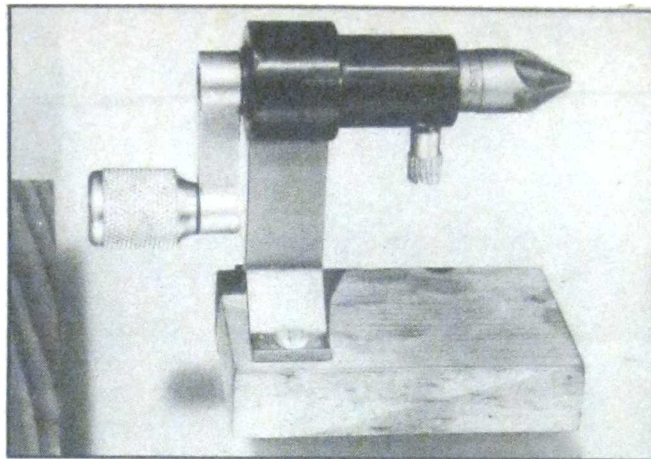
It's true: Not all reloaders have a metal lathe in their shop. If you don't, you might consider cozying-up to your local dry cleaner, after verifying that there is a lathe in *his* shop. To the gifted machinists among the readership, please control your raucous hilarity. I am not of your fraternity and that's the best way I've been able to dope out the procedure to the present. My formal training at the operation of lathes consisted of less than two months, forty-two years and a bit ago, plus random scraps of cafeteria-style self-teaching since then.

MEASURING CASE LENGTH

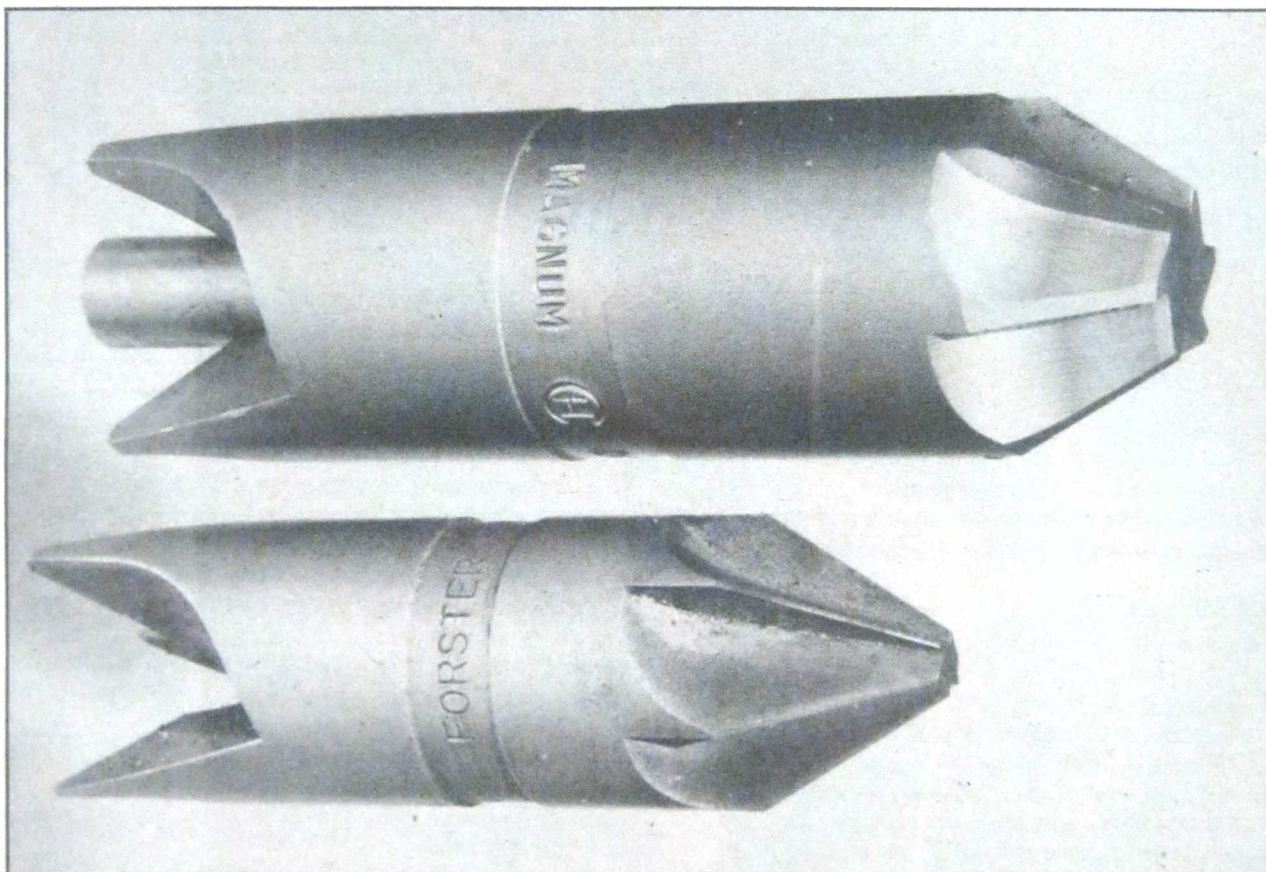
Since commencing work on this edition, Lyman has marketed a dial caliper that reads to .001-inch, or 1/1000-inch, making it quite a simple matter to check case length. In earlier editions, I've devoted a few pages and copious photographs to explaining how to read a vernier caliper to the nearest .001-inch. Bill Mauldin, of Willie & Joe fame and legend, is a gifted machinist, light-years beyond my modest attainments, but he tells me he never quite understood how to read a vernier caliper until he bought a copy of ABC/R-1.

In high probability, dial calipers will displace verniers in much the same way electronic calculators have aced-out

the humble slide rule. As a prophet, I'm a total loss, with no insurance. However, I suspect that electronic progress is due to make some drastic changes in certain aspects of reloading. At the moment, there are a few electronic, digital-readout powder scales that appear to perform quite well. The catch is that the suggested retail price is around \$500 or so. I can recall when ballpoint pens cost \$30 and, some years later, when the early examples of pocket calculators were price-tagged around \$300. Today, the pens run from free with advertising message to a buck or less. Calculators are given as premiums, also, and for \$60, you can get one so smart as to make Archimedes blow his brains out in hapless envy.



A remarkably handy little crank stand from Forster permits use of either end of their inside/outside case neck deburring tool.

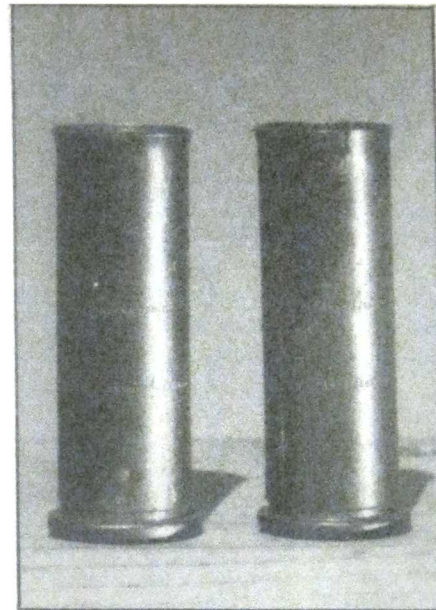
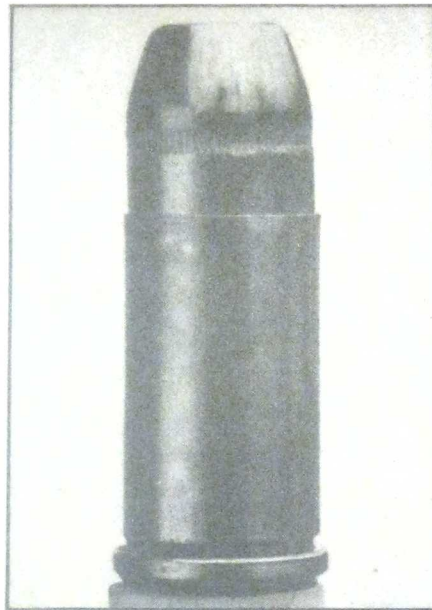


Lower item here is the Forster deburring tool installed in upper photo, and the upper one is the large economy size of the same useful tool, as designed by Tony Sailer and available from C-H.

So hark all ye to my prediction: The time is approaching when you'll be able to buy a robot powder measure. Set the appropriate dials, pour the propellant of your choice into the hopper, press a button and it will dispense 37.3 grains 17.9 grains, 77.4 grains, whatever you requested. It will drop a fresh charge every time you push the button. The first examples will cost around \$285 — I don't offer odds on that — but after a few years, the tab will get down to a bit

less than fifty bucks, provided inflation hasn't progressed to the point where newspapers are five bucks a copy for the weekday editions. I by no means discount that possibility.

That was another tangent and I apologize. All bottleneck cases should be checked frequently and routinely for excessive length. The time to do that is after full-length resizing. Drawing the expander plug back out of the neck tends to elongate the case by some varying small amount



Regarding crimping and flaring of case necks, the .32 H&R mag and .32 S&W Long at left are examples of the rather heavy roll crimp often applied to revolver cartridges in factory loads. My own preference leans toward a gentler taper crimp. The .45 Auto Rim in the center photo has what I regard as the ideal amount of neck flare; so little you can hardly see it, but enough to ease the seating and avoid gouging. The two .38 Special cases at right are a painful example of over-flaring and its usual result, namely a split neck and ruined case.

and a case that miked okay going in may come out over-length. If it's over the specified length, it needs to be trimmed back to the prescribed dimension. Many makers offer case trimmers and I've never seen a bad one yet. The two makes I use most are the Forster Brothers job and the ones from Lee Precision. By no means does that imply that other makes are not equally precise and functional.

THICK CASE NECKS

Again, this is a malady peculiar to the bottleneck cases and the method of detecting the condition is of the utmost simplicity. No elaborate testing devices are required. All you need is a bullet of the appropriate diameter, such as you'd use in reloading. With the case still in as-fired condition, try to insert the base of the bullet into the neck of the case. If it enters easily, you have no problem and can reload that given case at least one more time with no problems, providing it's not over-length.

The case neck, as we've noted several times thus far, needs to have a small amount of clearance within the chamber at that point so the pressure of the powder gas can expand it to release the bullet for travel up the bore. If the neck gets thick to the point its outer diameter meets the chamber wall, the releasing becomes progressively more difficult and the peak chamber pressures go up in a manner to justify extreme concern.

There are two approaches for rectifying thick necks. You can ream excess brass out of the inside or you can shave it off the outside. Forster Brothers have a series of neck reamers for the popular calibers that can be installed

in their trimmer in place of the pilot plugs normally employed in trimming. These reamers must be used *before* the case is resized. If used after resizing, they will remove so much brass that the case will be ruined for further use.

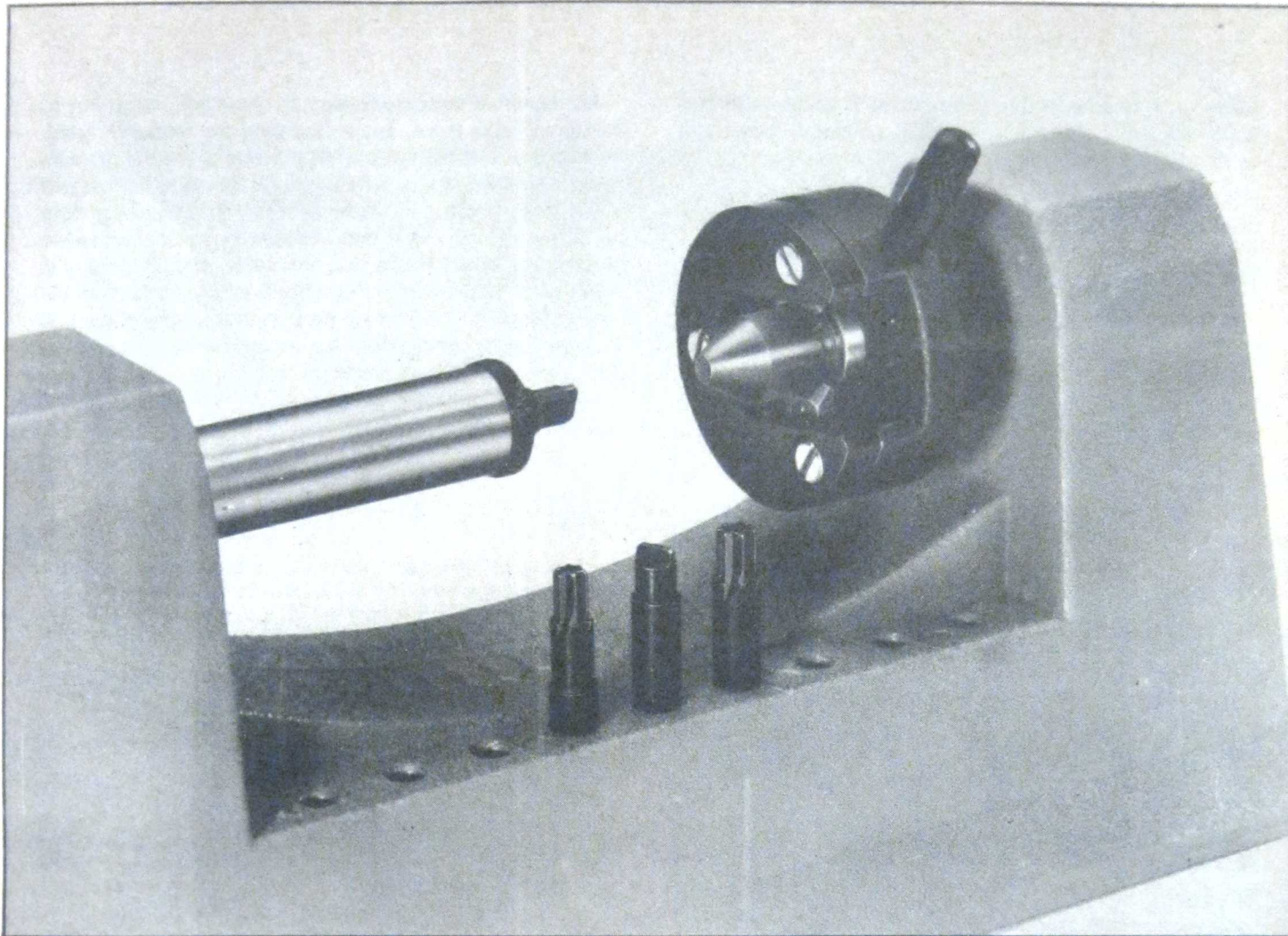
The front tip of the Forster Brothers reamers are tapered and thus can be used to uncommonly good advantage for chamfering the inside of the case mouth so as to assure easy and flawless seating of the bullet base. The stop collar on the trimmer is adjusted to take just the merest "wipe" out of the mouth, perhaps 1/64-inch or so. I've come to prefer this approach in favor of using the inside case neck deburring tool after trimming cases, since the angle is more gradual and there are no chatter-marks.

When reaming the inside of case necks, always be sure to tap the inverted case gently on the wooden bench top or a similar non-marring surface to dislodge the brass shavings from inside the case.

CASE LUBRICATION

If you shove a brass case up into a steel resizing die without bothering to apply some manner of lubricant to its outer surfaces first, it may adhere so tenaciously to the inner die walls as to wrench the rim off when you try to pull it back out. To get out of that predicament, you need a stuck case removing kit, as offered by several of the makers of reloading dies. It consists of a #7 drill bit, a ¼-20 tap and a hex-socket ¼-20 screw with a collar.

The first step is to get the decapping pin and expanding plug back up out of the way, then drill out the primer pocket with the #7 bit and tap the resulting hole ¼-20. Put the tip



Here's a view of the business end of the Lyman case trimmer, with handy recesses for storing the pilots or the bits for cleaning or reaming the military stamped crimp from primer pockets, as well as trimming cases.

of the bolt through the collar and on into the tapped hole in the case and use the supplied hex-wrench to extract the stuck case back out of the die.

You will probably have to use a hacksaw and/or file to free the expander and decapper from inside the case but it's no matter, as that case is far beyond further hope of salvage by then. You may wish to display its ravaged remains prominently as a reminder not to make the same mistake again.

Straight-sided cases such as the .38 Special are not apt to stick in the manner discussed, even if not lubed. You will, however, experience an ever-increasing amount of galling and scratching as bits of case metal rub off and attach themselves tentatively to the inside of the die. If you wish to avoid the bother of applying and removing case lube on straight-wall cases, the better course is to buy a resizing die with a carbide insert. Most diemakers use tungsten carbide, a few such as Redding use titanium carbide. Carbide, being second only to the diamond in hardness, will not embed the way the hardest steels do and it will burnish the sized cases in a manner pleasing to the eye.

Just because a little lube is mandatory, do not assume a lot of lube is even better. Like any fluid material, lube is utterly incompressible and excess amounts of it will migrate to the shoulder area to leave unsightly dents in the case at that point. The objective is to apply a thin, but uniform, coating of lube to the case walls and neck area; none on the shoulder portion, at all. Application by rolling cases across an uninked rubber stamp pad, to which the sizing lube has been applied, is a preferred technique, particularly if you've a lot of cases to handle and wish to save time. When I'm not in a hurry — and I regard it as a bad thing to reload in a hurry! — I prefer to get a thin film of lube on my left thumb and first two fingers, rubbing them against each other to distribute it uniformly and then rotate the case with the right hand, applying lube to the sidewalls and neck with the fingertips. The synthetic lubricant from Huntington Die Specialties (Box 991, Oroville, CA 95965) works uncommonly well in this application.

LOADING VIRGIN CASES

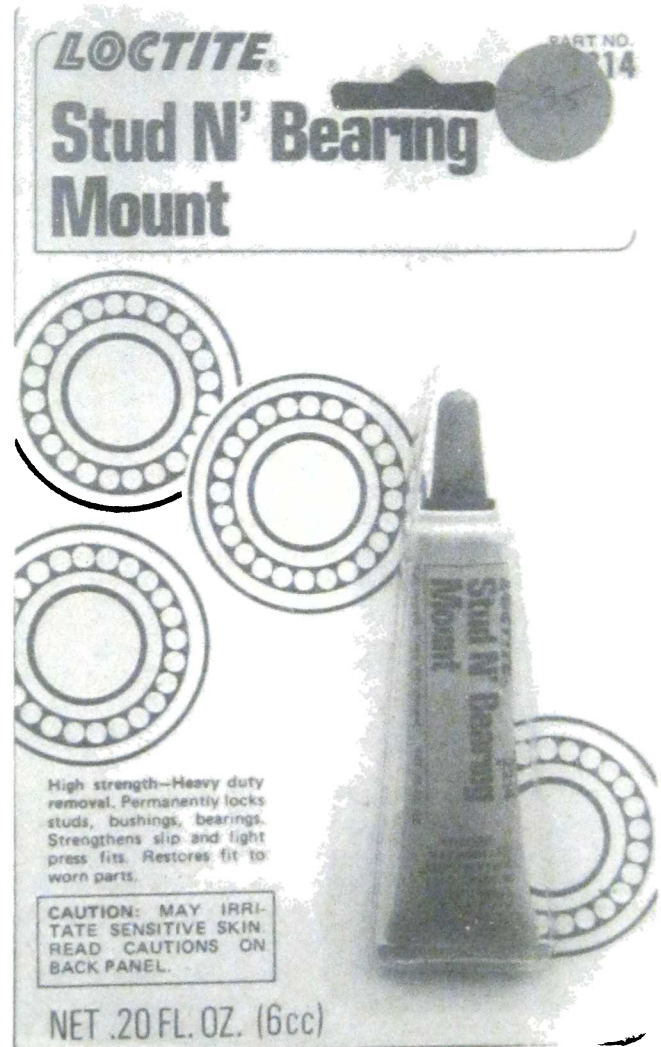
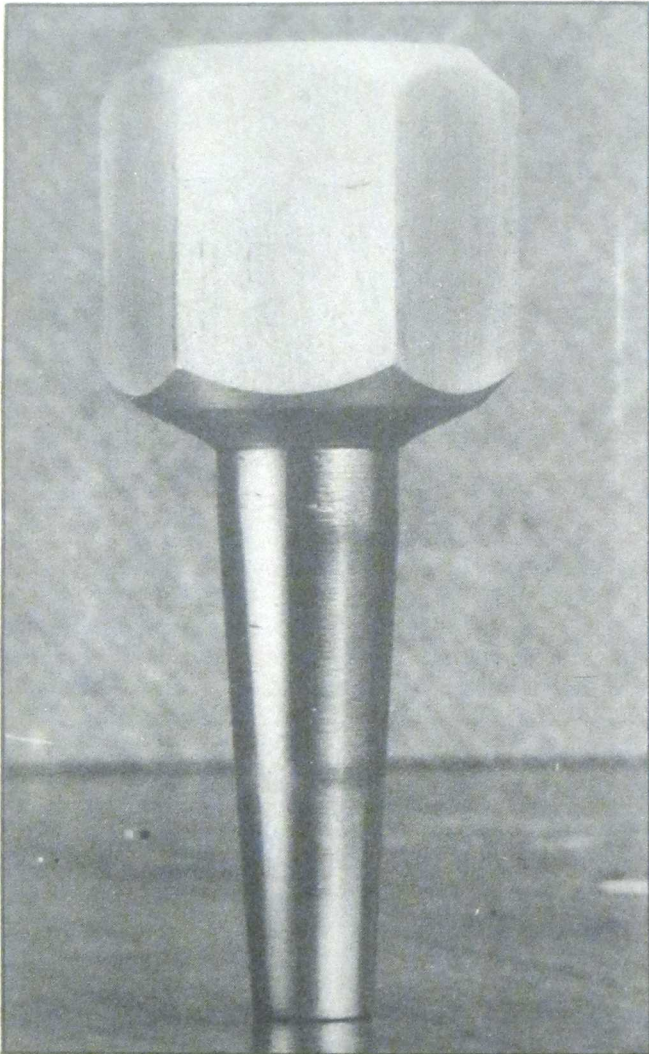
Reviewing the foregoing, it occurred to me that I'd neglected to comment upon what to do if you've purchased

some never-before-loaded brass at your friendly neighborhood emporium of shooting supplies, primed or unprimed, as the examples may be.

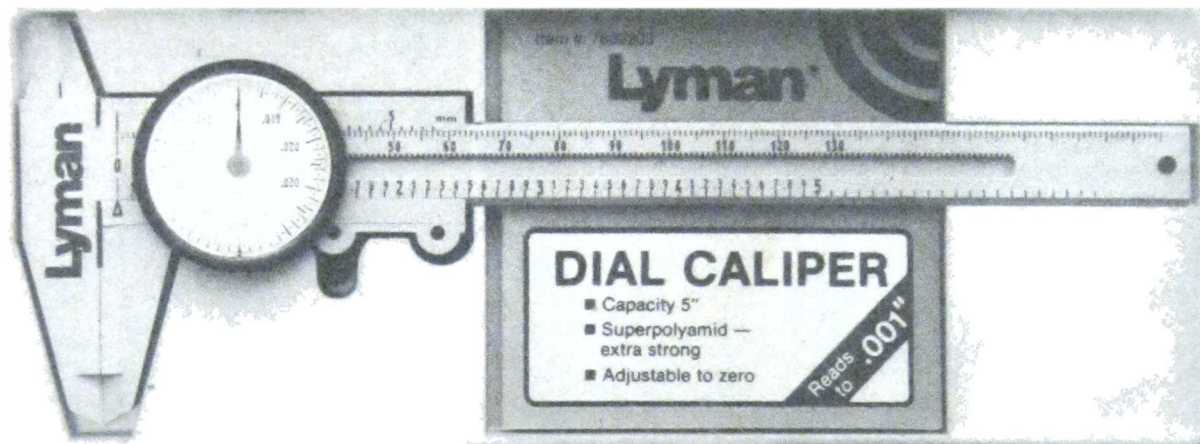
There is every plausible reason to assume that all you need to do is seat the primer — if obtained in unprimed state — and go on to drop in the charge and seat the bullet. That, alas, is not necessarily true.

Examine the cases thoughtfully and you're apt to note that some of the case mouths have readily visible dings and irregularities. If you attempt to seat bullets into them as received, you are apt to snag the necks and ruin the cases for further use; a painful state of affairs, surely!

It's rarely, if ever, necessary to trim such cases, nor to full-length size them, but a pass over the expander plug, including a slight amount of neck flare as may seem indicated, will do wonders to help you get them loaded without any hitches. Even if you spot no dents in the mouth, a light application of an inside neck deburring reamer will aid in guiding the bullet bases into the necks smoothly. In the instance of cases with vulnerably thin necks, such as the .44-40 WCF, you'll want to press some manner of tapered expander into the neck to make certain all of it goes outside the bullet base during seating. Something such as the Case-Neck Coaxer, illustrated and described earlier here, works quite well for such purposes.



Left, I call this a Case-Neck Coaxer; just a tapered pin with an aluminum handle I made up for coping with those occasional cases that didn't get the necks opened quite enough to accept the bullet. A push with this down into the neck does the trick nicely, but it's usually necessary to empty the powder, then replace it. Loctite is an anaerobic sealant, meaning it sets in the absence of air. The grade shown is the strongest of those offered in the handy stuff.



A good, reliable caliper is an incomparable blessing around the reloading bench and Lyman recently introduced this model with a dial readout to 1/1000", also written .001-inch. It measures inside/outside/step and depth.

REMOVING MILITARY STAMPED CRIMPS

The best thing about military cases, usually, is the moderate cost of them. In those examples having the primers heavily stamp-crimped in place, it's a minor hassle to get the old primer out and a major one to get the new one in.

There are two ways to get the stamped crimp out of the way, so as to prepare the primer pocket for seating a fresh cap. You can swage the crimp aside, or you can ream away the excess and unwanted metal from around the edge of the primer pocket.

Swaging involves a considerable amount of stress and thus generally requires a firm support in the form of a rod held against the inner end of the case head. Such support rods usually have a small relief hole in the center of the end to avoid burring the inner edges of the flash hole. Systems that support the case by the rim during swaging may distort the rim before the primer pocket is properly throated.

The alternative approach involves use of a small reamer in either of the two primer pocket diameters — approximately .175-inch for the small size, .210-inch for the large size — and Lyman recently offered a small kit of parts for use with their case trimmer that includes the two sizes of primer pocket reamers as well as primer pocket cleaners in both sizes. All four accessories are on shanks threaded 8-32.

Never one to turn a crank when I can turn on a switch instead, I've made up a small adapter to go into the chuck of the drill press, with its lower end drilled and tapped 8-32 to accept the four accessories. I find they work extremely well under power. You need a small support mandrel to go on the drill press table and, once properly positioned and

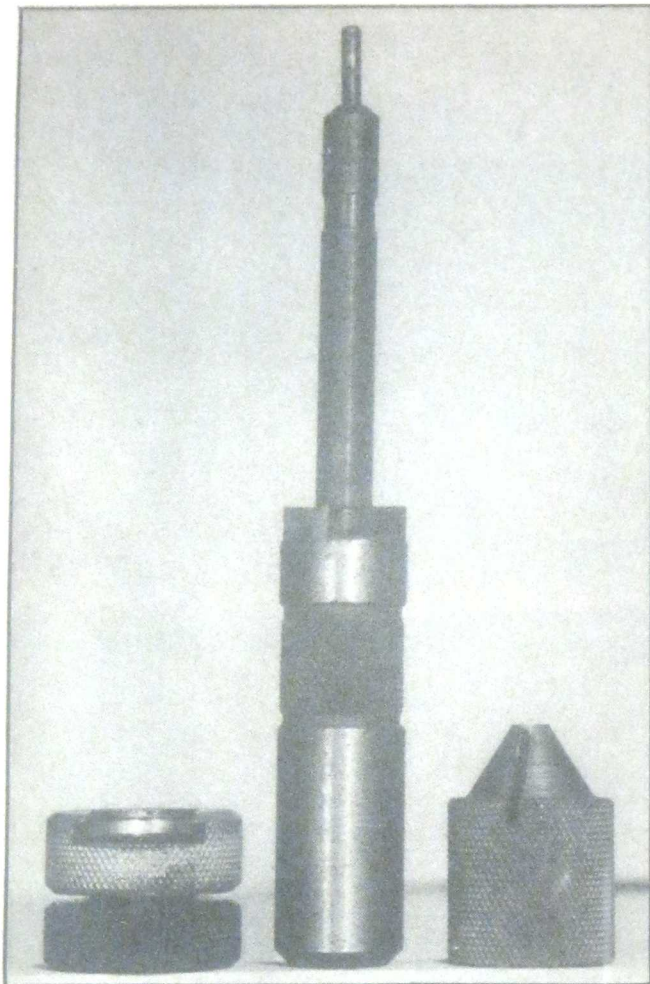
centered, it can be C-clamped to the press table to maintain the desired alignment as the cases are processed.

Such mandrel support bases are not overly difficult to make, even if you don't have a lathe, provided you do have a decent drill press. Cold-rolled bar stock — inexpensively available by the yard at most hardware stores, in 3/16-, 5/16-inch and several other common diameters — can be cut to suitable length with a hacksaw. Determine the length by poking one end of the rod up into the case and marking the position of the case mouth. Add the thickness of the base you plan to use and just a little bit extra for good measure.

The 3/16-inch rod will be about .1875-inch in diameter and will fit up into the neck of a .223 (5.56mm) military case without further work. The 5/16-inch, being about .3125-inch in diameter, may not offer an easy fit inside the mouth of a fired caliber .30 case such as the 7.62mm NATO (.308 Winchester) or the .30/06 Springfield. If that's true, you can dress it down by chucking the cut-off piece in the drill press, turning on the motor and applying a flat file to the spinning workpiece. Be sure to leave the right amount at full diameter to go into the support base by inserting one end into the chuck by about that distance. As you file away, keep trying the case mouth over the exposed end of the rod to determine when you've removed enough.

The 5/16-inch bar stock will serve for 9mm Parabellum case supports, with ample clearance and supports for .45 ACP can be made from 7/16-inch bar stock (.4375-inch diameter).

Ammunition for National Match competition, usually headstamped MATCH or NM, is put up in cases that are *not* stamp-crimped. At least I've never encountered any that were. Typically found in calibers such as .45 ACP, .308 Win. and .30/06 Springfield, match brass is among



The Lee Precision case trimmer can be turned by hand or installed in a 1/2" chuck of a drill press. Working with deprimed cases, the pin governs the final length of the trimmed case, as further noted below. Lee's inside/outside deburring tool at right.

the finest you can get, I think. To date, I've never come across any 5.56mm match brass but, if it exists, it's probably great stuff, too. I don't suppose they make .30/06 match loads these latter years, but there is still a goodly quantity of it in the appreciative hands of the nation's reloaders and I mention it here for that reason.

STEEL CASES

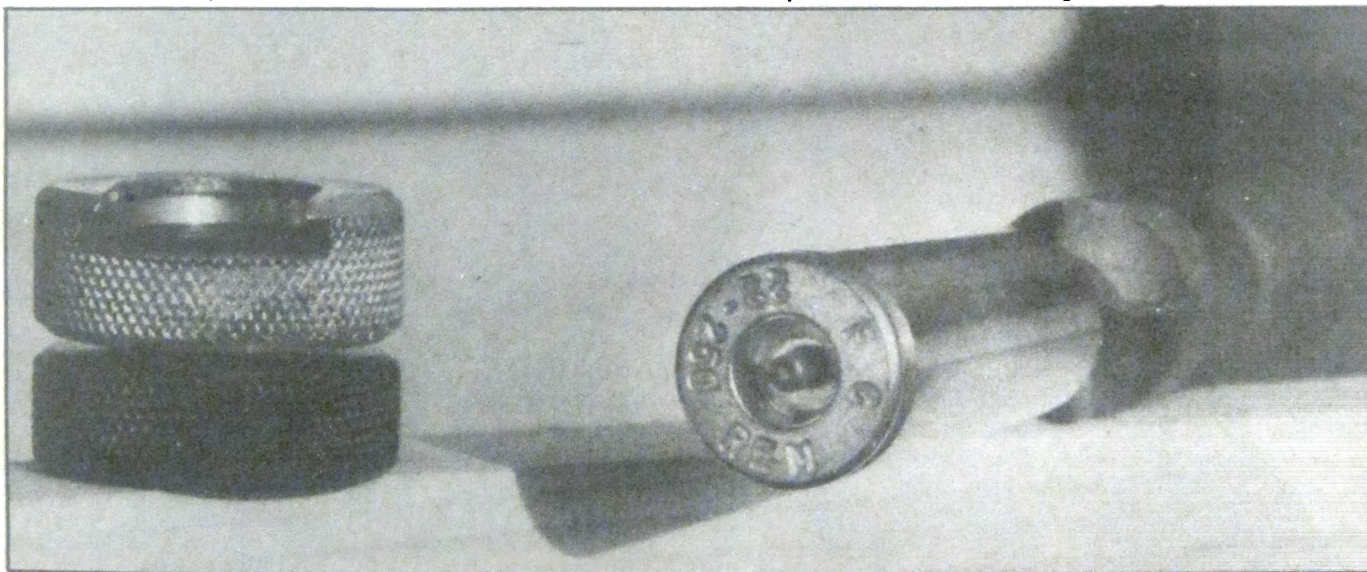
Copper was one of the most critically scarce of all war materials during WWII and its alloys such as brass were likewise in short supply. By way of helping the sparse supplies to go around, they tried making .30 M1 carbine and .45 ACP cases from steel and they worked reasonably well on the first firings. They may have used steel for cases in other sizes, but those are the two with which I'm familiar.

A problem with .45 steel cases — apart from their eagerness to rust, for that was in the days of corrosive primers — was a moderate reluctance to extract from the chambers of autoloading arms. I believe they were tumbled in some manner of dry lube to correct that problem at the time of original firing.

We must never forget that military ammunition is manufactured without any slightest thought or consideration for the welfare and benefit of possible future reloaders who may strive to cope with the empty cases.

Any lube added to the case to ease extraction of steel cases is not apt to remain in place through even the first

The tip of the pin of the Lee Precision trimmer can be seen protruding through the flash hole here. It bottoms against the solid steel boss at left. The reamer and boss are sold as one unit, interchangeable through all the calibers and the spacer rod and shell holder are sold to handle the specific caliber of cartridge case.





Various makers offer stuck-case kits, more or less similar to this one made by RCBS. As discussed, every now and then, a case may remain stuck in the resizing die as the rim is wrenched off. If that happens, a kit such as this will enable you to salvage the die and stay in business, but the bad news is you can kiss that poor case good-bye.

reloading operation. As a direct result, steel cases in .45 ACP are rather notorious for causing more than their fair share of broken extractors. For that reason, you may encounter sources that flatly state that steel cases should not be reloaded.

Far be it from me to contradict such learned pundits. I have Model 1917 and Model 25 Smith & Wesson revolvers chambered for the .45 ACP, or .45 Auto Rim. I've put a lot of steel-case reloads through both of those and have yet to encounter any problem of any sort. In theory, you use either the old military half-moon clips with .45 ACP ammo in such guns or the third-moon and full-moon clips currently manufactured by Ranch Products (Box 145, Malinta, OH 43535). In actual practice, even if you don't have a clip, you can usually wiggle one case loose with a fingernail and use the rim of that one to pry the others loose, or use the rim of a loaded round if you've gnawed all your nails to the quick and beyond.

Properly lubricated with case-sizing lube, steel cases will present no problems in hardened steel reloading dies

and they work equally well in tungsten carbide dies. Steel cases probably are at least as strong as brass cases and, quite possibly, are considerably stronger. That is one reason I've used them in the old Model '17 Colts or S&Ws, as both guns are not noted for their extreme ruggedness.

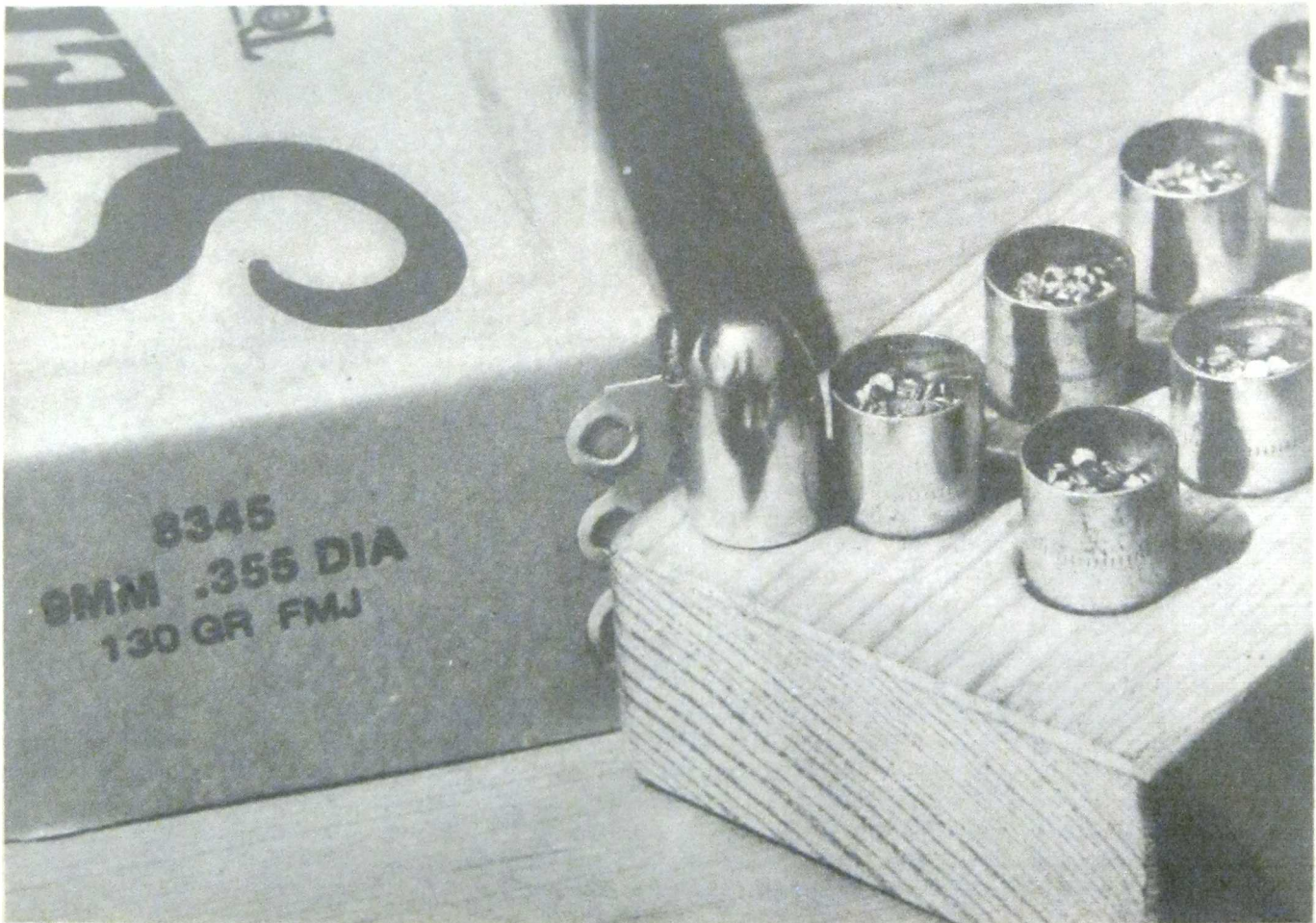
Speaking personally, I've never had a broken extractor in a Government Model .45 pistol due to steel cases and I've fired quite a few steel-case reloads in them over the years. That's not to say it couldn't happen and if you break an extractor while firing a steel-case reload, I am not inclined to remit you the cost of a new extractor plus installation and handling costs, so be duly aware of that.

Perhaps I've devoted overmuch wordage to the steel cases here. As the years scuttle along, they are encountered ever less frequently, same as the zinc pennies of 1943 or whenever it was. Reloaders, as a general class, are highly disinclined to throw anything away and I'm sure there must be a few here, a bunch over there, all across this broad land and in many other places as well, hence the commentary.

DISPENSING THE POWDER CHARGE

Discussing The Business Of Getting The Charge To Do
What You Had In Mind; No More And Certainly No Less

A gathering of 9mm Luger cases, each with its powder charge in place, awaiting the seating of the bullet.



THERE ARE TWO basic approaches to dispensing powder for reloading: by volume or by weight. I suppose you could also include counting it out, granule by granule and I'm reasonably certain that's been tried, without sufficient obtained advantage to justify the extra work or even come close to it. Several years ago, Jim Horton, of Trenton, Missouri, wrote to say he'd wondered if the red granules in Hercules Red Dot powder were identical in ballistic properties to the dark-gray ones that make up Red Dot's major bulk. So he sat down and segregated out the red flakes until he had enough to make up a few 12-gauge loads and try them out. Perhaps Horton and I can save you some time: They shot exactly the same as the mill-run mixture, he reported.

In theory, at least, charges weighed out individually with all possible precision should display markedly superior accuracy to those dispensed by any other method. In point of observed fact, it doesn't necessarily work out that way and yes, that seems a little unfair.

General observations, such as the foregoing, are subject to modification in accordance with characteristics of the given powder. Some powders can be measured by volume with impeccable uniformity and examples include the Winchester Ball Powders, the Hodgdon Spherical Powders, as well as the tubular numbers such as H4227, H322, H4895 or the Du Pont IMR series.

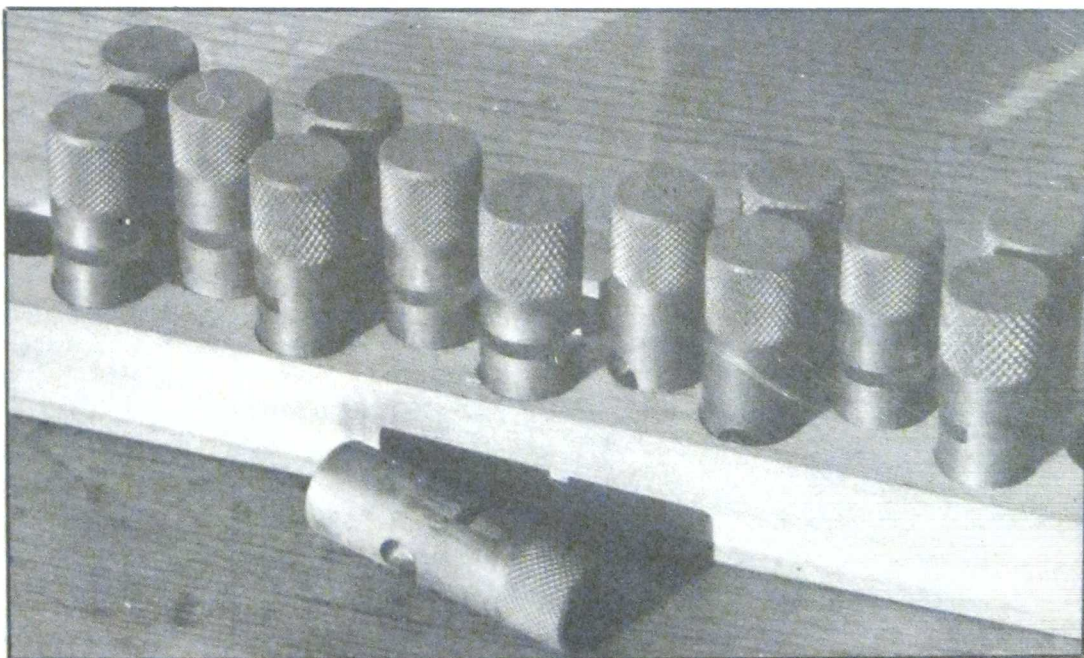
Powders that come in thin, broad and perhaps curly flakes — faintly resembling scaled-down Post Toasties — obviously may pose minor problems in uniformity of volume measurement. Subject them to varying amounts of vibration and other jostling during measurement, and they will pack down or bulk up correspondingly.

Vibration can and will pack any and all powders into substantially smaller volumes. The effect is more pronounced with the flaky types than with the globular varieties, as you might expect.

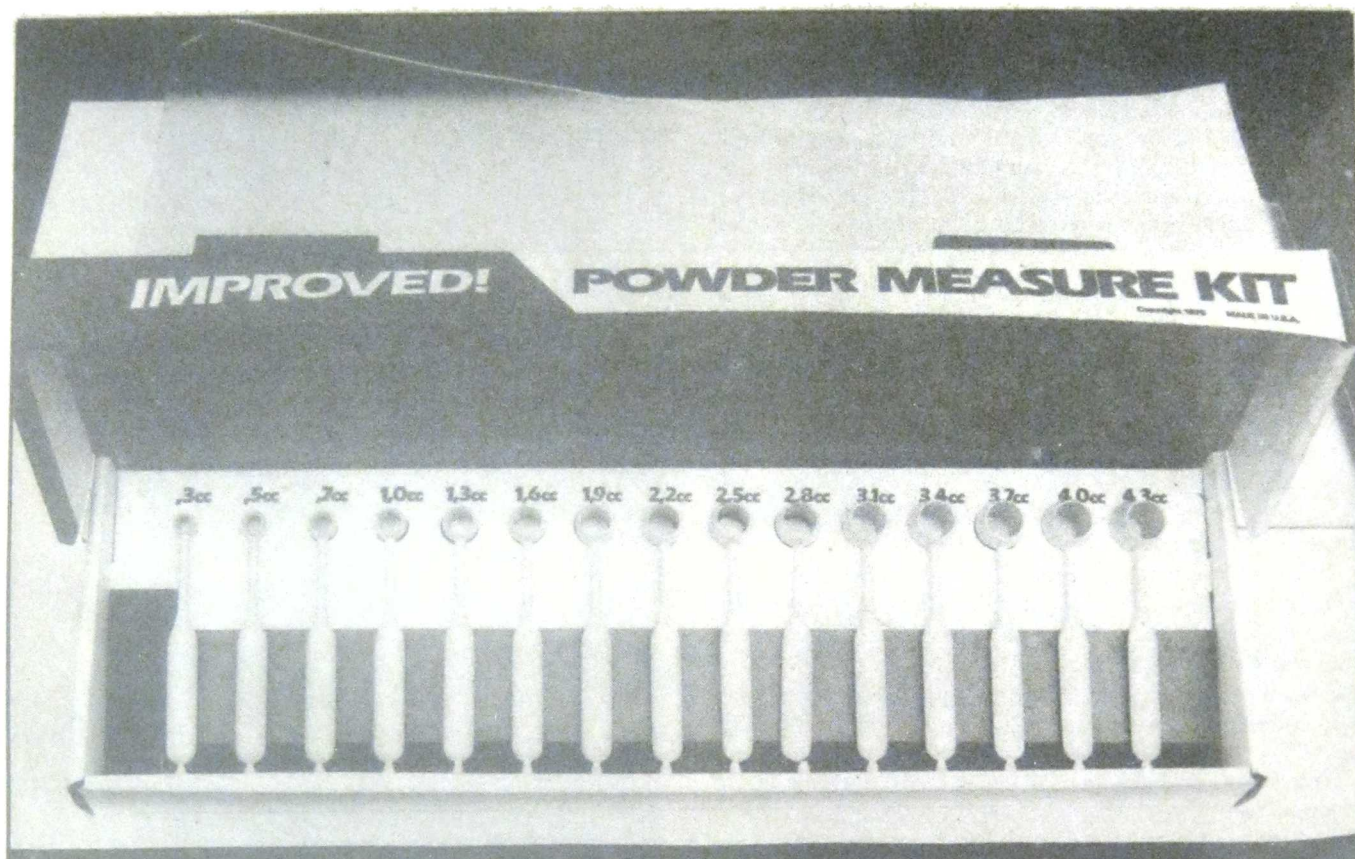
As has been noted earlier, powders vary somewhat from lot to lot and the variation extends to volume measure-



Here's a surviving example of the old Pacific rotor-type measure. The reservoir tube has been reversed because double-base powder has eaten at the plastic; a common problem.



A rack of brass rotors for the Pacific unit above. This measure has not been made for many years.



The powder measure kit from Lee Precision supplies fifteen dippers and a slide-rule-type chart.

**MEASURE
NUMBER**

**GRAINS
POWDER**

**POWDER
H 335**

TYPE

.3cc	4.7
.5cc	7.8
.7cc	10.9
1.0cc	15.5
1.3cc	20.2
1.6cc	24.8
1.9cc	29.5
2.2cc	34.1
2.5cc	38.8
2.8cc	43.4
3.1cc	48.1
3.4cc	52.7
3.7cc	57.4
4.0cc	62.0
4.3cc	66.7

IMPORTANT INSTRUCTIONS — GENERAL

- 1 Use only good load data such as that supplied by the manufacturer of the powder you intend to use.
- 2 Reduce all maximum pressure loads by 10%.
- 3 Avoid powders that are listed as being unsafe if reduced, such as Winchester 296 and Winchester 785.
- 4 Check and double check that you have the correct powder and measure.
- 5 To restore the anti-static condition to your powder measures, wash in a water and detergent solution (dishwater) and allow to air dry without rinsing.
- 6 Because we have no control over the use of these tools, manufacture and storage of the powder and components we cannot accept responsibility for the use of these measures or tables.

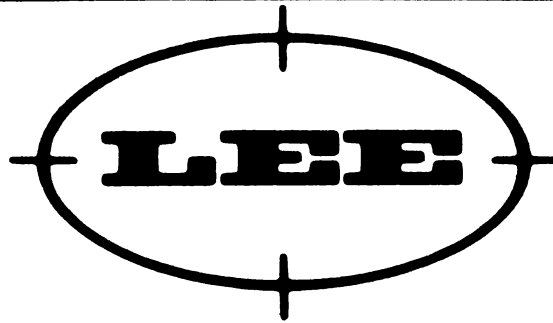
FOR SHOTGUN SHELLS

Use the measure that dispenses the recommended amount or slightly less. Never use more as many listed loads are maximum.

FOR RIFLE AND PISTOL CARTRIGES

- 1 If the loads listed are maximum reduce by 10% to allow for differences in powder density, components and rifles. A 10% powder reduction often results in only 5% velocity reduction and is usually more accurate.
- 2 Do not use powders that cannot safely be reduced such as Winchester 296 and Winchester 785.

A closer look at the chart, set for Hodgdon's H 335, shows the 1.9cc measure delivers 29.5 grains.



PROPER MEASURING TECHNIQUE

Push the measure through the powder only once. Give it a slight shake side-ways to level it off. Do not shake it down or add more.

For Maximum accuracy push the measure through the powder once and scrape level with a paper card.

Ammunition reloading can be dangerous if done improperly and should not be attempted by persons not willing and able to read and follow instructions exactly. Children should not be permitted to reload ammunition without strict parental supervision.

LEE PRECISION, INC.
HARTFORD, WISCONSIN 53027

A clearer view of the instructions on the left end of the Lee slide rule gives recommended procedures.

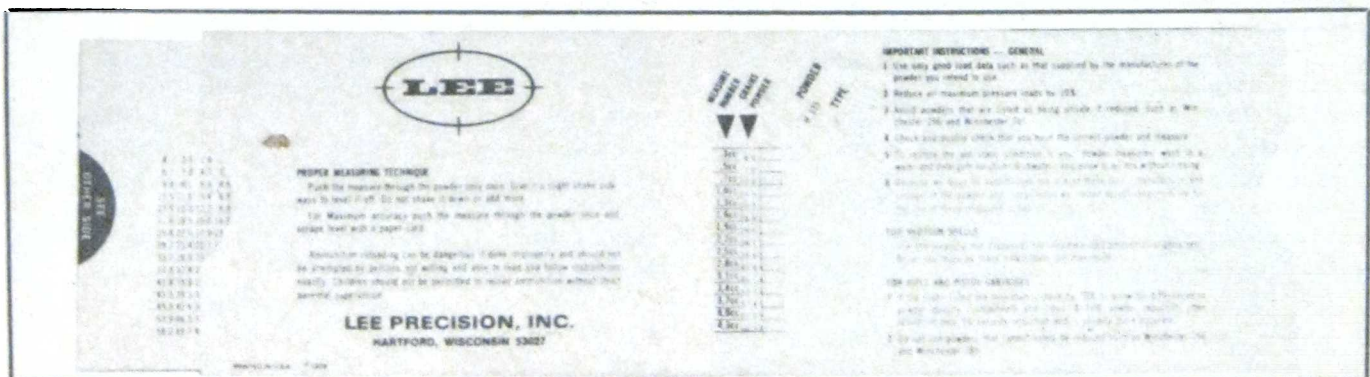
ment. Since the burning properties may vary within permissible limits, as well, it is always an excellent practice to spend a little time checking out a given powder from a different lot than you've been using previously. If you are working at the upper, brinksmanship pressure levels, that is particularly important.

VOLUME MEASURES

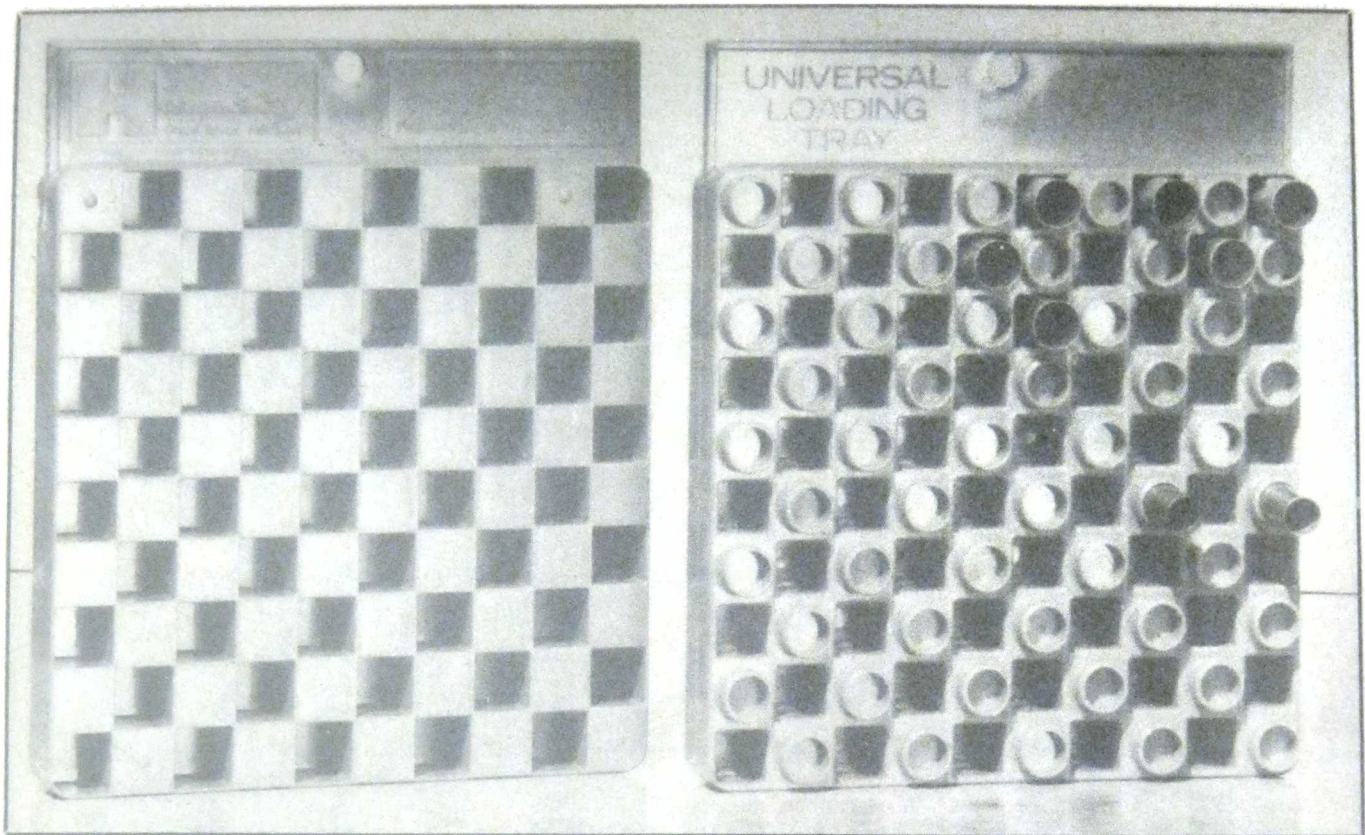
There are two basic approaches to volumetric powder

dispensing: fixed and adjustable cavities. My first inclination was to term them fixed and adjustable rotors, but some of the cavities operate by sliding back and forth, or by moving up and down in order to be filled by the powder, so cavities seems to be the word to use.

Measures employing adjustable cavities absolutely must be verified as to the given charge weight by reference to a reliable powder scale. It is also a most excellent idea to check the fixed-cavity measures against the same sort of



Ninety-five powders are covered on the two sides of the chart. Inner card should never be utilized when removed from the outer sleeve because pertinent figures are offset from the heading for powder.



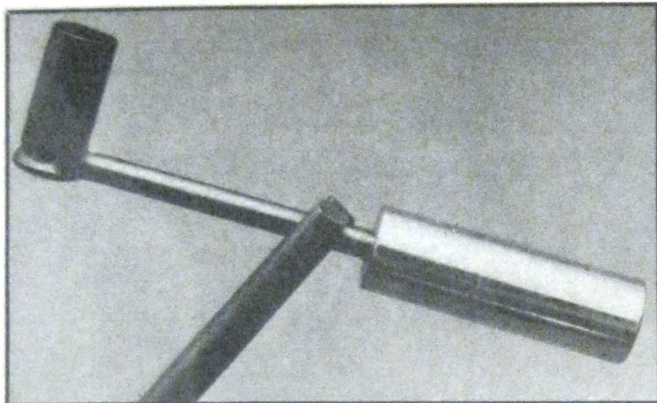
Loading blocks are quite indispensable for holding cases before and after dropping the charge of powder into them. I find it highly beneficial for peace of mind to drop all the charges, then inspect them under good light to verify uniformity of the level of powder in each case. With that done, I seat the bullets and feel reasonably certain there is one and only one charge in each and every case. If you do not feel inclined to construct your own loading blocks, Hornady offers a plastic unit that's reversible — both sides are shown here — and craftily dimensioned to cope with dimensional vagaries of practically every known cartridge.

scale. As elsewhere noted, my preference is to drop ten charges into the pan of the scale and weigh them to get the average drop figure, dividing by ten. This procedure sort of amplifies your accuracy sensitivity by a factor not exceeding ten.

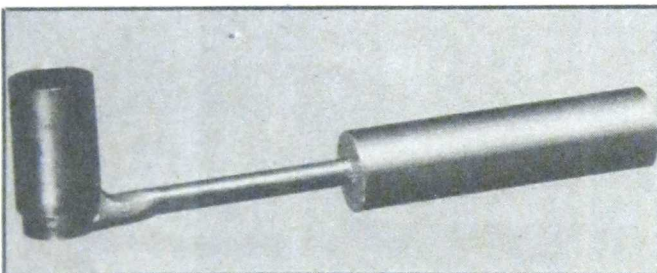
In the few years since its introduction, I've become extremely fond of and partial to the RCBS Little Dandy powder measure. Quite a lot of years earlier, Pacific — then in Lincoln, Nebraska, in the days before it was purchased by Hornady — brought out a small measure for use with a number of fixed-cavity rotors and I became awfully attached to that in its brief day. It had a little integral clamp that permitted mounting to any handy surface or you could pick it up and go down the line, dealing out charges into the necks of load-ready cases positioned in a loading block.

Pacific personnel of that distant day sent along a few blank rotors and I managed to custom-drill a few of those for metering out charges of a volume not otherwise to be had.

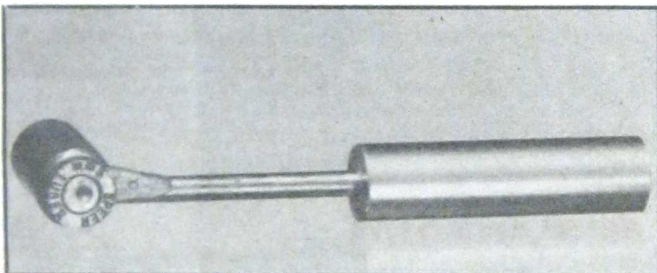
Richard J. Lee — whom I tend to think of as the Henry Ford of the reloading industry — has made up and marketed various kits of dipper-type measures down the years. The dippers were an integral part of the inexpensive Lee Loader kits on which so many of today's hull-stuffers cut their teeth and won their spurs. Prior to the early Sixties, when Lee was introducing complete pocket-sized reloading kits at a retail tab of ten bucks or so, hardly anyone gave serious thoughts to reloading the large, bottlenecked rifle cases by use of a dipper-type measure. Lee changed their thinking on that, and mine too, comes to that.



A latter-day version of the long-ago dipper that used a spent .25 ACP case for its business end.



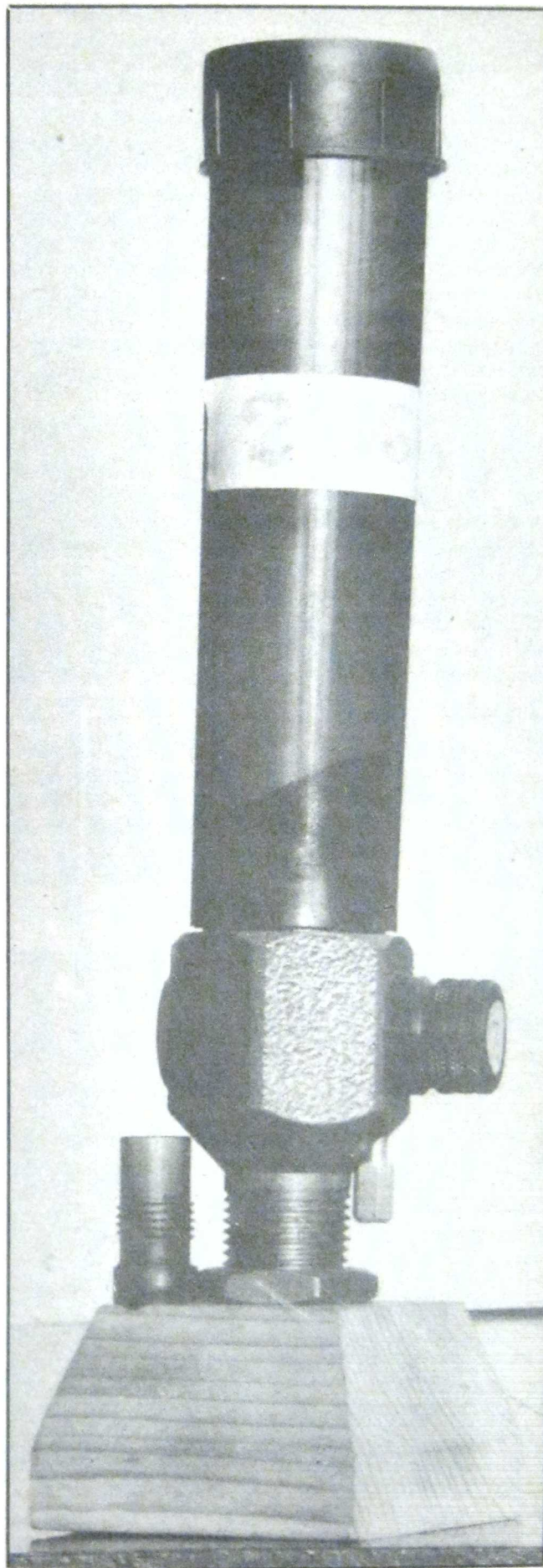
Here's a larger homemade dipper, consisting of a 9mm Luger case with its rim turned off to simplify the operation of soldering to the handle.



Another view of the 9mm dipper, none too neatly soldered. For reasons that should be obvious, it is necessary to make sure the primer is dead! Such measures need to be drop-checked closely.

Those were the days when I lived not far from Lee's base of operations and, as it came to pass, one of the tightest groups I've ever coaxed out of my old \$25 Springfield sporter in .30/06 was fired with 130-grain Speer JHP bullets powered by charges of IMR-3031 personally dipped by Lee himself one balmy Sunday afternoon in Lee's "back-forty" target range. It spanned a wee tad under three-quarters-inch, between centers, at one hundred yards and I couldn't help being impressed. I've made up a lot of loads to fire through that nice if inexpensive old rifle, before and in the many years since, but nothing has zapped down into quite that tight a cone of focus out of it; out of other rifles, yes, but out of that one, no.

One of the RCBS Little Dandy measures, full of 296 and carrying rotor #7, resting in a simple block that has a second hole for the spare nozzle.



A tangent here: We were probably shading the odds a little by using the Speer 130-grain caliber .30 JHP bullet for, in my gathering experience, that is one reliably miraculous projectile. Any time I'm working with the .308-inch bullet diameter and need a neatly impressive group to photograph, I've become heavily inclined to try the 130-grain Speer and I cannot recall any instance in which it ever did a bad group for me. There have been many times when it turned in groups I felt disinclined to try to beat. I've no faintest idea as to how it expands upon impact. I'd guess it probably would expand, but I can't recall having ever fired one at anything other than paper targets. On those, its track record is truly legendary. Ambo

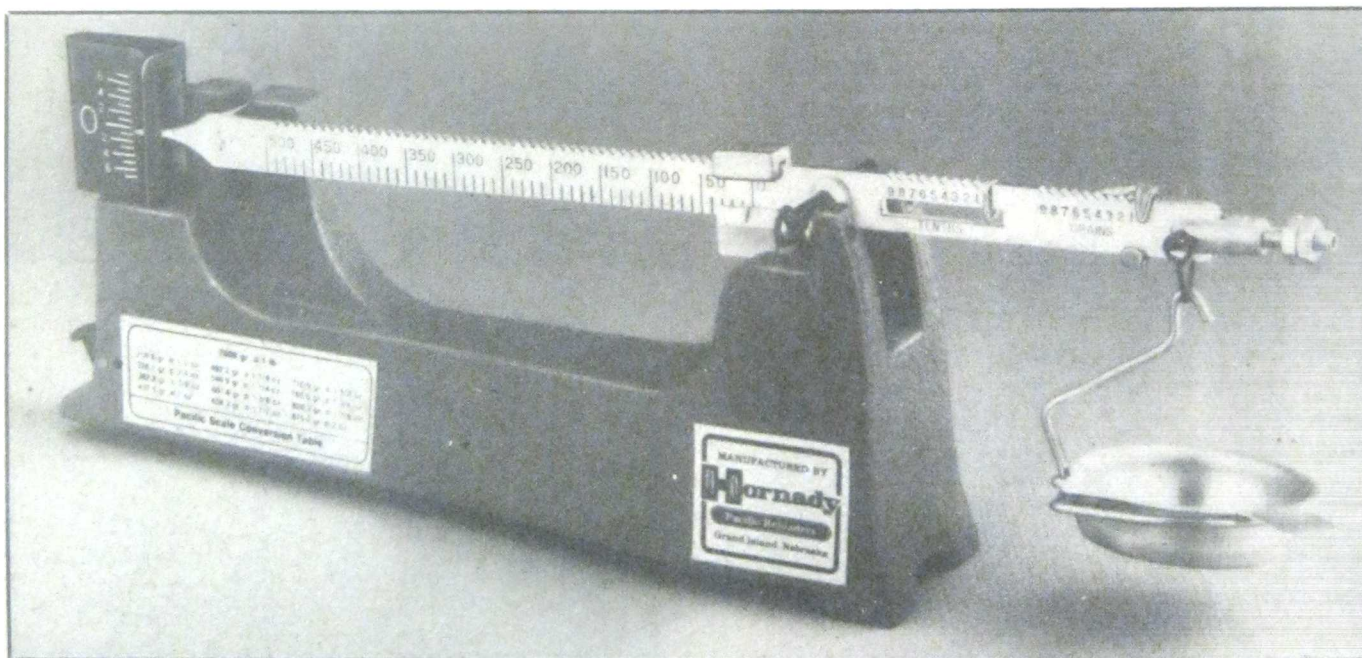
Quite definitely, there is a preferred technique for employing a dipper-type powder measure. Observing suitable precautions against fire hazards, you pour the powder supply into a small, non-sparking container. You push the base of the dipper down into the powder and allow the granules to flow in over the edges of the cavity and fill it so it's slightly mounded-up at the completion of the dip. Then you give a judicious shake of the wrist to decant the excess granules back into the container, leaving the dip about level with the top of the measure.

By all means, resist any temptation to give the handle of the dipper a few gentle raps against the edge of the container. Just a sideways shake to flick off the excess is all it takes. Have a powder funnel handy for getting the measured charge out of the dipper and on down into the mouth of the case.

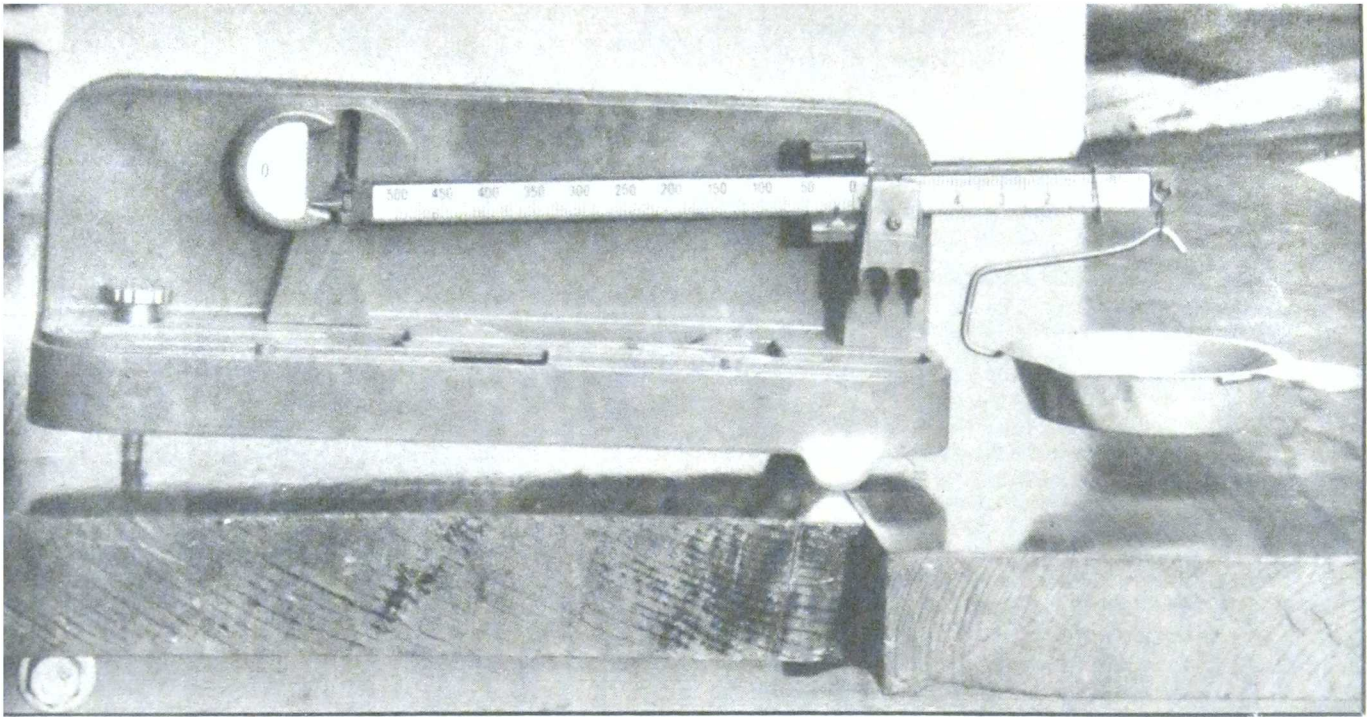
The latest version of the Lee powder measure kit contains fifteen dippers instead of the original thirteen and a slide-rule-type chart covering the "drop" of each dipper for ninety-five different powders. That ciphers out to about 1425 different powder charges, quite a few of which have no practical utility, but they're given anyway. The capacities



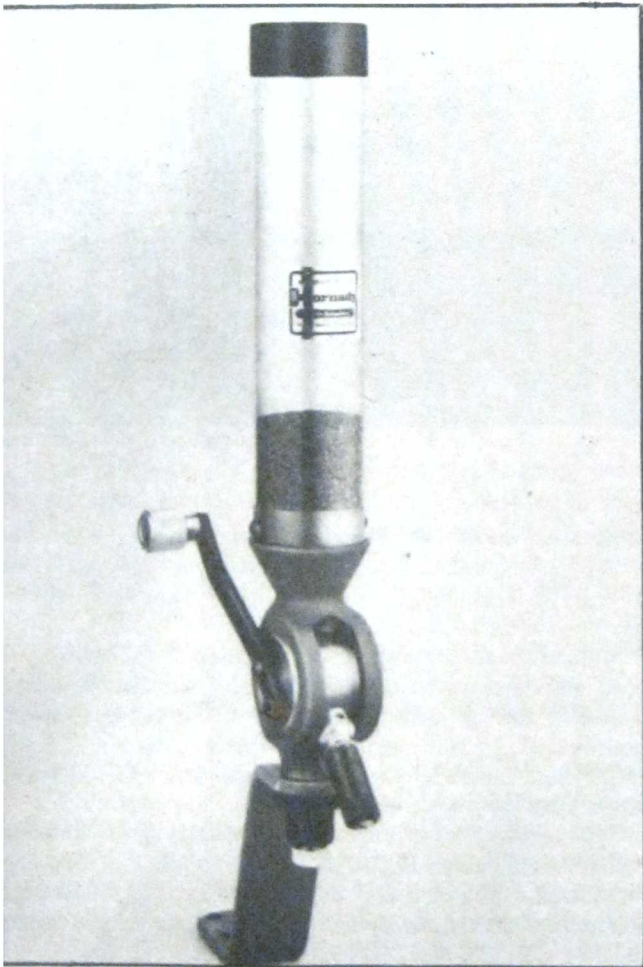
Simplest way to keep track of Little Dandy rotors not in use is to store them in one of the 12-gauge shotshell boxes, such as this one from MTM Molded Products. I've made up holding screws that turn out by hand in place of the slotted-screw types that come on the measure: saves hunting screwdrivers!



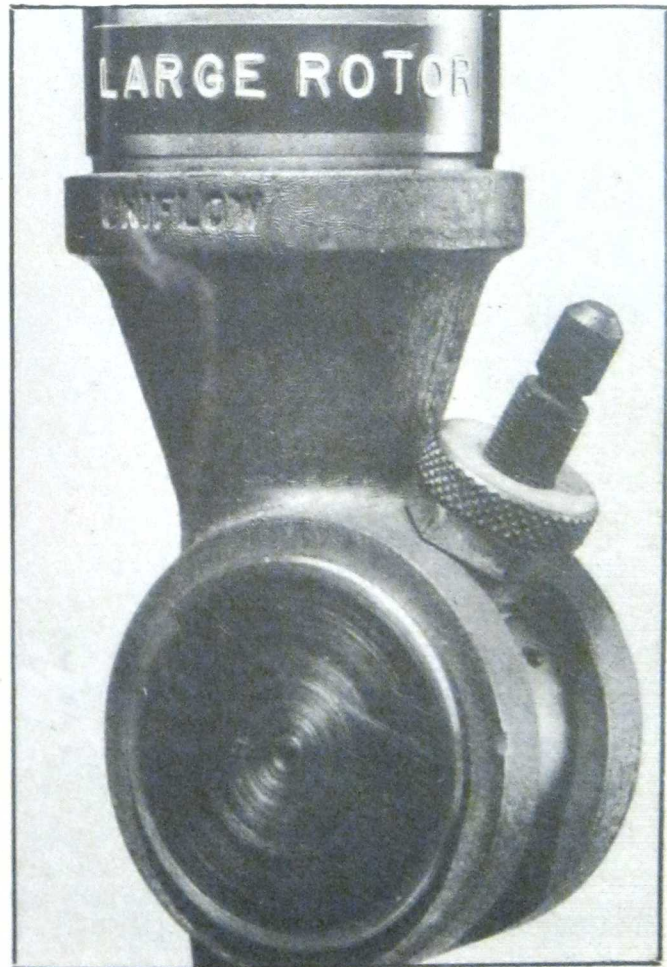
A good powder scale is the reloader's best friend and here's a good one from Hornady/Pacific that goes to 500 grains. Like most such scales, a bar of copper at the left end rides between poles of a magnet. That serves to dampen the oscillations of the beam via electromagnetic principles for a useful saving of time.



Not the first powder scale I ever bought, but I've been using this old Lyman/Ohaus for upward of twenty years, mainly because I've gotten accustomed to it. These have been off the market for years. It is, however, important to understand the graduation system of your scale so as to be absolutely sure of accurate readings!

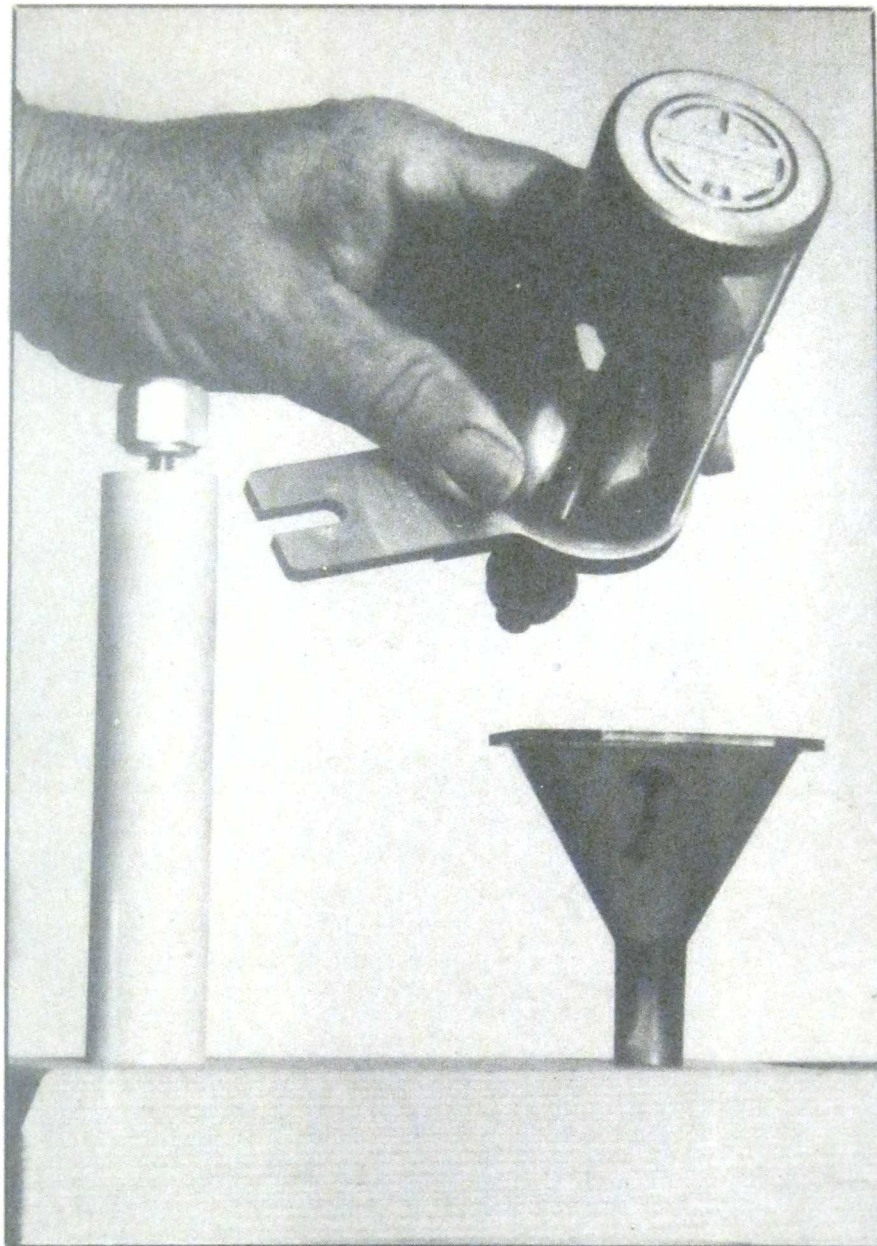


Hornady has a neat and elegant powder measure.



My RCBS Uniflow with the larger size of rotor.

A novel design is the Francis Quick Measure. It's supplied with four adjustable drop tubes and a specialized funnel that can be used for dropping the charge directly into the case mouth. It's shown here with a simple stand I made up for holding it.



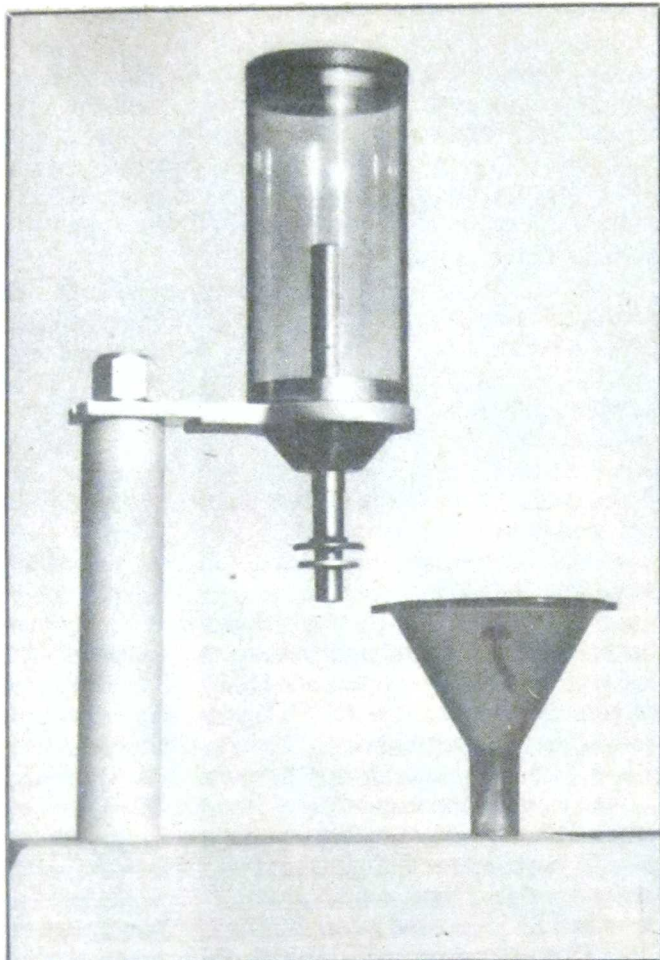
of the dippers are given in cubic centimeters (cc) and they range from .3cc to 4.3cc. The latter, with Hercules Bullseye powder, parcels forth 40.4 grains and I doubt if there is any cartridge/bullet combo of any sort for which 40.4 grains of Bullseye is a suitable and sensible driving charge, but the information is listed anyway. It must have represented an incredibly monumental amount of work and expended person-hours.

The mention of ninety-five different powders for reloading may levitate an eyebrow here and there. Included are Reloder 7, Reloder 11 and Reloder 21, although the last two have not been available for many years. Omitted are Hi Vel 2 and Hodgdon 570 and 5010, but included are both Win. 630 and Win. 630 P. If anyone has the erroneous

impression those last two are closely similar, be advised that 630 P weighs 13.9 grains per cubic centimeter and 630 is 15.0 grains/cc. That's quite a significant difference.

Reloaders of the world, *attendez vous*: Don't ever try to load Winchester 630 powder according to earlier load data specified for use with Winchester 630P on a grain-for-grain basis! If you do, you are going to get one goshawfully HOT load. The two powders are by no means identical and interchangeable with each other.

Setting the chart supplied with the Lee powder measure kit back to Hercules Bullseye, I note that the .3cc dipper is rated for 2.8 grains, the .5cc drops 4.7 grains and the .7cc delivers 6.6 grains. As a veteran user of Bullseye in copious



Quite obviously, the stand is too short to be used with the funnel atop a case, but it can be used to drop into a scale pan and from there into the case mouth.

quantities (a pinch here, another pinch there!), that strikes me as lacking in the degree of versatility one might desire. If you fancy dispensing 3.3 grains, 3.5 or even 4.0 grains, there's no ready way to do it.

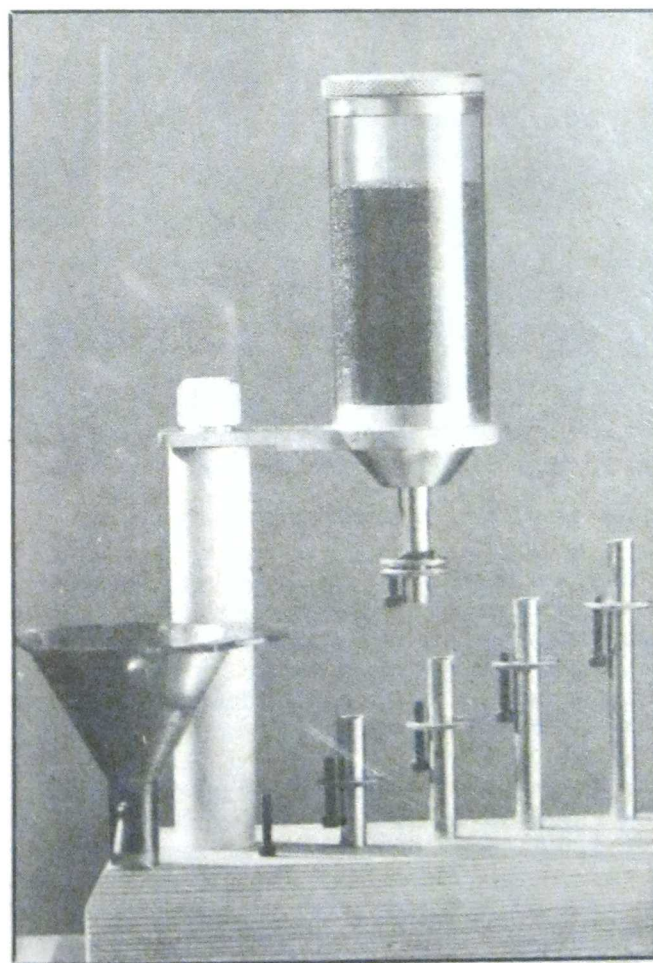
Well, yes there is, if you have a decently accurate powder scale and a reasonable gift of manual dexterity. You can make your own dipper-type measures. That was an approach I followed once in the long, long ago, around 1951 or so. I didn't have a powder scale at the time, but I seem to have had Mr. Mulligan, my Irish guardian angel, and his attentive services sufficed. Unless you've good reason to believe the vigilant Mulligan is looking over your shoulder in a protective role, I suggest you put your faith in a good powder scale, *instead*.

I would much rather not think of how many hundreds and thousands of rounds of .38 Special ammo I reloaded before I finally managed to plank down the greenies and get a powder scale of my very own. Early in the game, I scrounged up a spent .25 ACP hull, soldered it to one end of a nail, made a small wooden handle to put on the other end and, *Zotz!*, there was my dipper-type powder measure for the reloading of the .38 Special case, using the Lyman #358425 bullet mould that turned out a capable little wad-

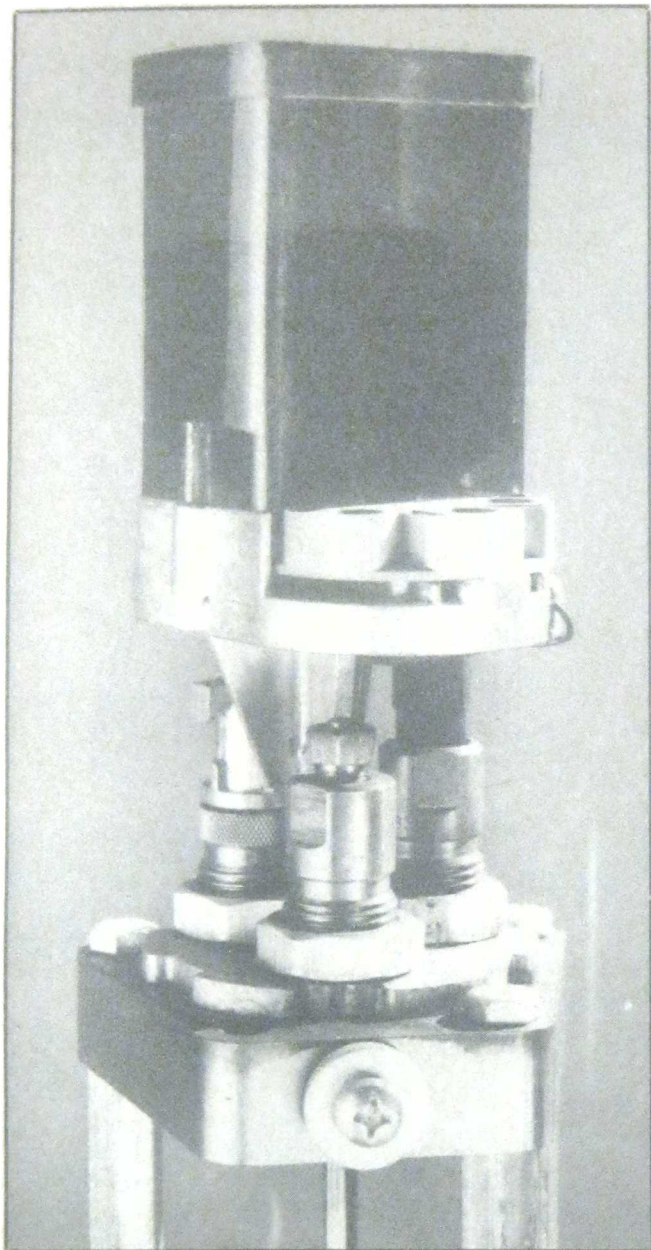
cutter weighing about 115 grains. Don't look for that one in the latter-day Lyman charts because they dropped it from the list, several years back.

When I finally managed to achieve ownership of a powder scale, I was quite interested to find out that an empty .25 ACP case, soldered to one end of a nail, appears to scoop up roughly 3.3 grains of Bullseye, give or take the odd peck. As it all turns out, that is a decent and live-withable charge in the .38 Special for bullets ranging from hardly anything up to around 158 grains or so. If anything, it is a bit on the modest side. The #10 Speer Manual, for instance, shows 3.9 to 4.5 grains of Bullseye for their 148-grain wadcutter bullet in .38 Special and 2.7 to 3.0 grains of Bullseye for their 148-grain hollow base wadcutter (HBWC) bullet. The HBWC must always be loaded lightly, lest its delicate skirts get wrenched off to remain lodged in the bore. As I never loaded HBWC bullets in those primitive early days, it posed no problems. For their 158-grain lead bullets in .38 Special, Speer lists 3.8 to 4.2 grains of Bullseye and, again, the 3.3-grain charge out of the .25 ACP case is comfortably below maximum levels.

Despite that, or perhaps because of it, I got a lot of really excellent groups out of my old S&W K-38, using 3.3 grains of Bullseye behind the 115-grain Lyman #358425 wadcutter, and it wasn't all that cumbersome to use, once you got the hang of it.



Longest tube, at right, is available as an option. Due to novel design, the FQM never shears a kernel of powder in use.



The Lee Auto-Disk is an ingenious design made up for use on the Lee turret press. It rides atop a case mouth expanding collar.

The basic dippermaking approach can be adapted to any of the small handgun cartridge cases and they can be turned shorter on a case trimmer in order to custom-tailor the weight of the charge they dispense. By all means, check them carefully on an accurate powder scale and then, if you wish, etch the charge weight of the given powder on the handle, or label them in some other manner.

The great virtue of the fixed-cavity powder measures, I think, lies in their reliable repeatability. Once you've established the weight of the charge they drop, you can be pretty certain they will drop the same charge at any given later date, provided you are using the same lot number of the same powder. If you get the given powder with a different lot number, check both the charge weight and its resulting performance before assuming it's essentially identical to the lot you had been using.

THE RCBS LITTLE DANDY

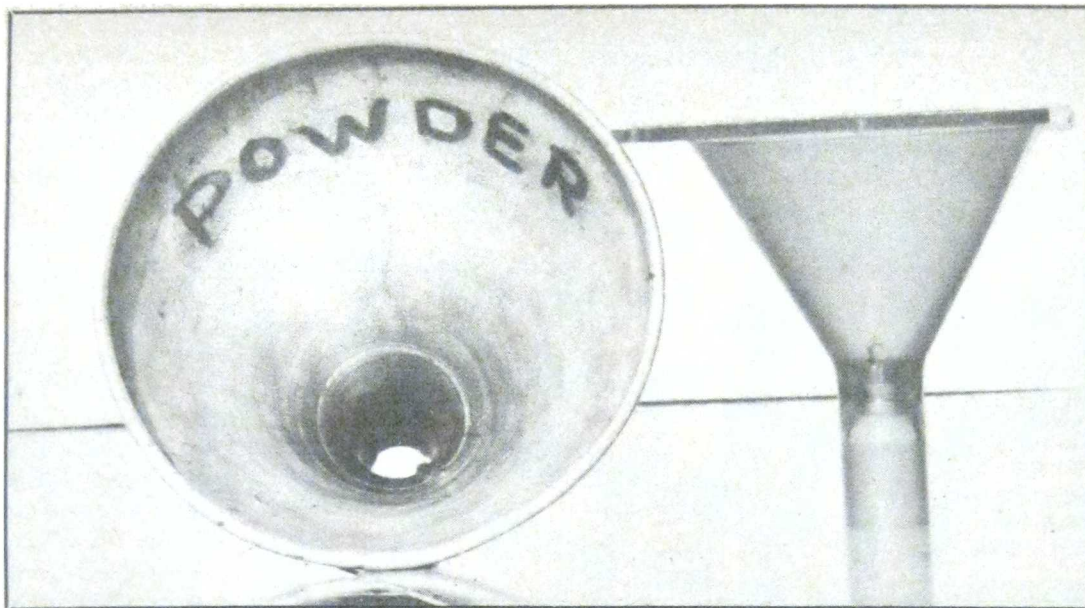
Introduced in fairly recent times and developed to serve as the powder measure for the RCBS Green Machine progressive loader, the Little Dandy has a selection of twenty-six different charge rotors and it is supplied with a chart that gives the *approximate* charge weight with each rotor for several different powders. The instructions stress that it must be checked against an accurate powder scale and I would certainly second that motion.

I maintain my own reference charts for the Little Dandy rotors, on a series of sheets of paper that were ruled and run off on a copier. Each sheet has twenty-six numbered lines and is divided into vertical columns which I head with the name of the powder. When I have occasion to use a given combination of rotor and powder, I drop ten charges into the scale pan, weigh them, divide by ten and enter the figure on the chart, starting a fresh vertical column if I've not used that powder before.

I find it interesting to compare my chart to the one furnished by RCBS. Some come out dead-on while others vary in either direction. By way of illustration, I'm going to list a few examples, but I want to stress that you still need to run your own check on your Little Dandy, with powder out of your can. As with the RCBS figures, mine should be considered only approximate. That's to say, they work for me, but I'll not guarantee they'll work the same for you.

I use a considerable quantity of Hercules Blue Dot and, as a result, my notes for that powder are more complete than for most others. I should note that if, for example, ten charges weigh a total of 68.5 grains, I show the average drop as 6.85 grains and so on. RCBS shows no figures for Blue Dot with rotors #01 through #08, noting that no known recommended load exists for such charges and, as far as I know, they're correct in so stating. These, then, are the RCBS figures, followed by the average weight I get, for rotors #09 through #26, using Hercules Blue Dot:

Rotor #	RCBS (grains)	DAG (grains)	Variation (%)
09	5.9	6.1	+3.4
10	6.5	6.85	+5.3
11	7.1	7.34	+3.4
12	7.7	7.8	+1.3
13	8.4	8.65	+2.9
14	9.1	9.3	+2.2
15	9.8	10.0	+2.0
16	10.6	10.6	---
17	11.3	11.36	+0.5
18	12.0	12.1	+0.8
19	12.8	12.7	-0.7
20	13.5	13.4	-0.7
21	14.2	14.1	-0.7
22	14.9	15.0	+0.6
23	15.7	16.0	+1.9
24	16.6	17.1	+3.0
25	17.5	17.8	+1.7
26	18.3	18.3	---



Aluminum funnel at left is labeled to prevent its use for crankcase oil. It's for getting powder back into the can. Plastic one at right is for getting powder from scale pan into the case neck.

I trust you see what I mean and I hope it was worth the bother for both of us. The RCBS charge weight was dead-on twice out of eighteen times. The maximum proportional variance was a little over five percent, although that represented a difference in weight of only 0.35-grain. The greatest discrepancy in actual weight was with the #24 rotor: 0.5-grain.

The same general technique seems to work well for calibrating the Little Dandy to use with powders not listed on the RCBS chart and they omit several of those. For example, they don't show Du Pont PB, 800-X, SR4756 or SR7625, or Norma 1020, Alcan AL-5 and AL-7 and several others. Admittedly, some of those are no longer in ready availability, but I happen to still have generous quantities of some of them and intend to keep on using them up.

I find it a great convenience, when recording the pertinent details of a load or series of loads, to be able to enter a note such as 6.7 grains of Herco, followed by a parenthetical (LD14) so that, should I ever wish to make up more of the same load, it's a simple matter of installing the #14 rotor, pouring some Herco in the hopper and getting right into production.

Keeping track of all those rotors can pose a problem but the solution is easy: Just store them in one of the MTM 12-gauge plastic shotshell boxes, with the numbered end up-permost. The box holds twenty-five and you can keep the odd one in the measure.

As noted elsewhere, the stamped number isn't as clearly visible as one might wish and I've gotten around that by affixing small circular labels to the ends of the rotors and inking in the number for improved visibility. The #6 and #9 labels have a line drawn beneath the numbers to tell them apart and, for good measure, I use green labels for the even numbers, red labels for the odd numbers.

I often use the Little Dandy in one of the stations of my old Hollywood turret press and find it works extremely well. It's equally handy when used hand-held to drop

charges into case mouths as held in a loading block.

WEIGHED CHARGES

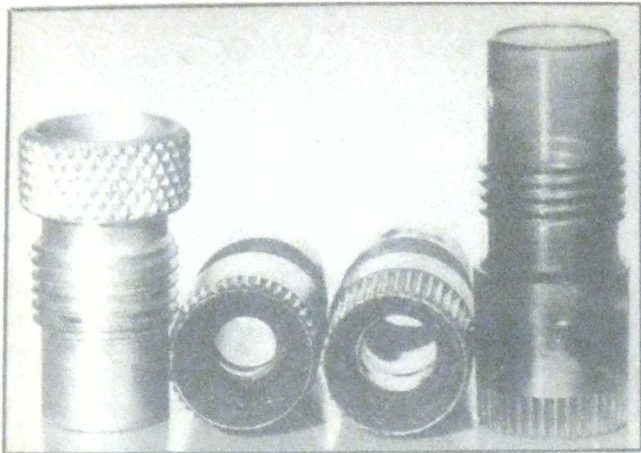
It is entirely possible to weigh each charge individually on a powder scale and use a powder funnel to decant it from the scale pan into the case mouth. The usual procedure is to use an adjustable or fixed measure of some sort to meter out nearly the final weight and then add the small amount needed to balance the beam of the scale. A great many firms make or have made powder tricklers designed to dribble the powder into the pan a few granules at a time. My usual procedure is to just grab a pinch of powder between thumb and forefinger, releasing a granule or two at a time and giving the scale beam a light nudge from time to time to see how close it's getting to the final weight. On some scales, you can trickle quite a bit of powder into the pan and suddenly the beam will break loose and the pointer will go to the top and stop. Then you've got to ladle out some powder and start all over again.

Candidly, I do not make a frequent practice of weighing out a large number of individual charges. Given a good powder measure with an adjustable chamber, the uniformity from charge to charge seems entirely adequate. At least as often as not, loads from the powder measure will outgroup loads with individually weighed charges and, since the weighing isn't all that much fun, I find it hard to justify the bother.

ADJUSTABLE MEASURES

If the fixed-cavity measures are quick, handy and repeatable, the adjustable measures offer the advantage of infinite versatility. If you decide you want 14.3 or 11.7 grains of a given powder, it only takes a few minutes of patient twiddling, together with checks on the powder scale, and you are throwing charges of just exactly that weight, or of any other weight you happen to fancy.

Most such measures have some manner of locking ar-



Most adjustable powder measures, as well as those using a fixed rotor, provide nozzles with at least two orifice diameters, as here.

rangement to maintain the adjustment, once set. After adjustment, tighten the locking ring or screw judiciously and form the habit of checking it occasionally on long runs to make sure it hasn't worked loose and allowed the charge weight to change.

The obvious problem with powder measures is that the charge weights span across such a broad range; from one grain or so to ninety or more. There are quite a lot of powder measures that start at some given point and go up from there, while others start at zero and cut off at some higher weight.

RCBS gets around that particular problem by offering their Uniflow powder measure with a choice of two different rotors. One has a cavity and metering piston of larger diameter than the other and either can be installed in the measure, or you can do as I did and get two Uniflows, one set up for either rotor. I've had both of them since some time before Guy Lombardo did his thing to usher in the year 1960 and, as far as I've been concerned, it's been like the Boston ladies and their hats.

I'll explain: Someone was conversing with an upper-crust, Back Bay Boston dowager and, as it was the spring of the given year, asked if she were going shopping for a new Easter hat.

The lady looked down her imperious nose and quivered her dewlaps: "We Boston ladies *have* our hats!" she explained. Much the same for me. For the years since the latter Fifties, I've *had* my powder measures and have been supremely content with them. I think it would be lovely to live long enough to wear out an RCBS Uniflow, but in all honest candor, I do not really expect to do so. After a quarter-century or so of hard use, they seem good as new, except the emerald crackle paint is getting a wee bit faded.

Somewhere along the way, I seem to recall encountering some manner of adjustable powder measure that featured a micrometer-type series of graduations on the mechanism that moved the cavity piston. It seemed like a good idea. Once you'd gotten it set to disburse 33.3 grains of IMR-4064, you could record the micrometer reading and, next time you needed just that charge, you could spin the barrel to that setting, lock it in place and crank forth the charges. It was one of those great-sounding ideas that never quite seem to get off the ground, as witness the fact I can't even

recall the make or model of it. In a way, it was rather like these marvelous telescopic sights that enable you to measure the exact distance to the target and simultaneously adjust the reticle so you can hold dead-on at whatever distance and, it is to be warmly hoped, put the hole right there. I would not have such a scope up my nose if I had ample room to inhale the factory where they build the precious thing.

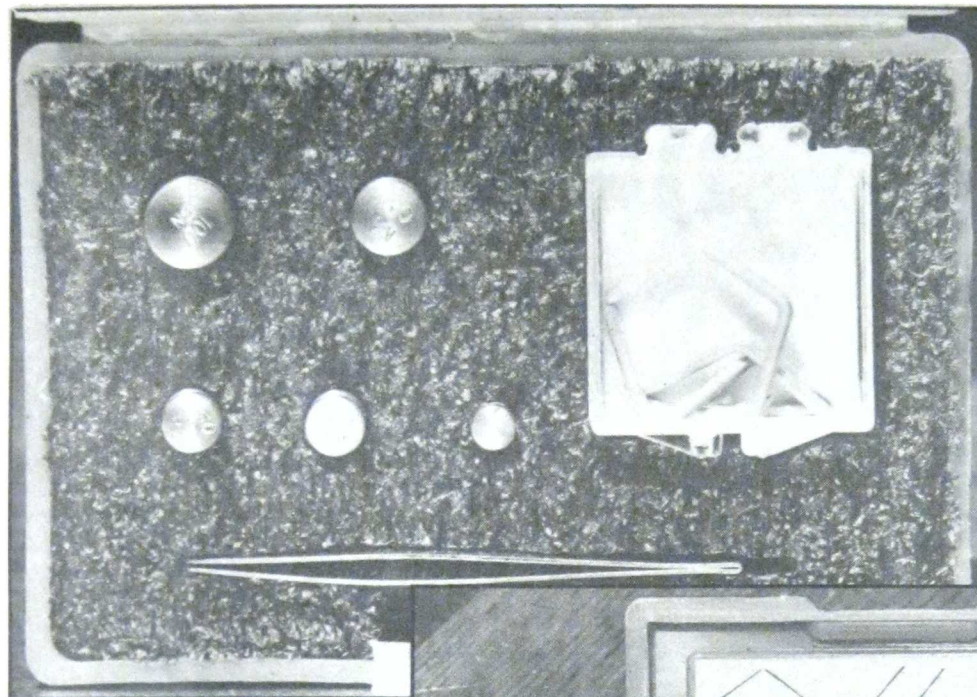
Be all that as it may, and I'm sure it will. If your powder measure runs out of room before delivering the charge you need, considering setting it for half the charge and cranking it twice. Skiffing through the #10 Speer Manual, the heaviest charge they list appears to be 92.0 grains of Norma Magnum Rifle Powder (MRP) for use with the 150-grain bullet in the 8mm Remington magnum. You might need more for the .460 Weatherby magnum, but they don't list that one. In any event, if you set a measure to drop 46.0 grains and then work the action twice, you should end up with 92.0 grains, pretty close. Check it on the powder scale to make absolutely certain!

Most adjustable measures are supplied with two interchangeable delivery spouts carrying holes of two diameters so you can get all the granules into a .22 case neck or perhaps even a .17 case neck, meanwhile using the one with the larger hole to get all 92.0 grains of Norma MRP into the neck of the 8mm Rem. mag case without being painfully reminded of hourglasses. It approaches being a universal law that, whatever delivery spout you're not using will either be impossible or darned hard to find, the next time you need it. I usually provide a small socket on the stand that holds the powder measure to contain the delivery spout not in use and this seems to help. Of course, you have to set it aside when you dump the unused powder back into the original container.

Several firms offer powder funnels for getting charges from the scale pan into the case neck and you'll need one of those, more than likely. You'll also need a somewhat larger funnel for getting unused powder back into the original container. Aluminum is the preferred material for such funnels and you may wish to have an additional funnel necked-down by the cut-off front end of a retired cartridge case, secured to the inside of the funnel spout by a few drops of Loctite, for coping with those containers having extremely small openings.

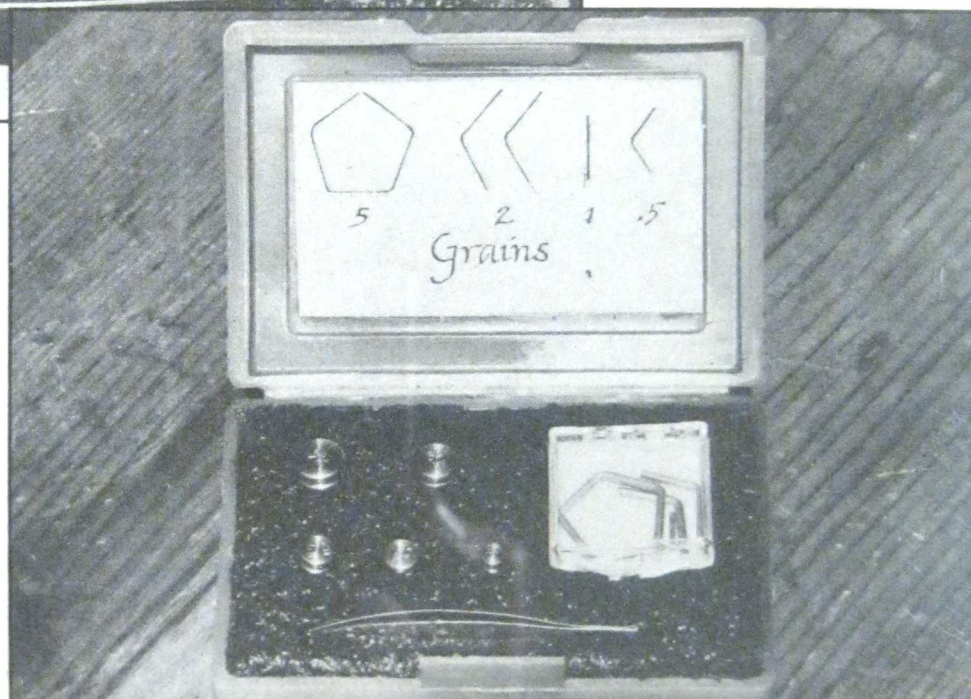
There are few things drearier than embarking upon a remote shooting/reloading safari, only to find you neglected to fetch along any means for getting the powder back into the can when you want to try some other propellant. It is possible to improvise a funnel from a piece of paper, though not especially easy.

As may be discussed elsewhere, one of the most vexing problems when it comes to taking the reloading operation outside your accustomed enclosed space is the effect of mischievous breezes upon the powder scale. Not only does a powder scale require a dead-level surface upon which to operate, but it becomes hopelessly hysterical if subjected to air currents. For the past many years, I've been experiencing occasional yens to design and build a remote powder scale enclosure setup, with provision for leveling and a windproof dome that can be brought down over it. I feel I am getting closer to that particular snapping-point with each passing *annum*. It certainly would be handy, if only it



Now offered by Lyman, this set of test weights is intended for verifying scale accuracy.

Chart pasted to inside of box lid identifies the wire test weights from 5.0 to .5 grains in weight.



were made up and available when needed!

You may experience faintly paranoid doubts and misgivings as to the innate, pinpoint accuracy of your powder scale and you have every sensible reason to do so. Most such scales are accurate enough for practical purposes when first unpacked from the box, but years of use may exact their toll.

Recently, Lyman made up and marketed a set of test weights for the purpose of verifying the accuracy or, comes to that, detecting the inaccuracy in powder scales. Such sets have been offered by other makers down the years, but Lyman's is the first in a long time.

If you've ever dabbled in the construction of model airplanes, building a remarkably sensitive powder scale is not a terrible challenge. Back in the days before I owned a proper powder scale, I managed to construct a balance out of balsa wood, using six Schick Injector razor blades for the friction-free pivots. It was incredibly sensitive. Drop a

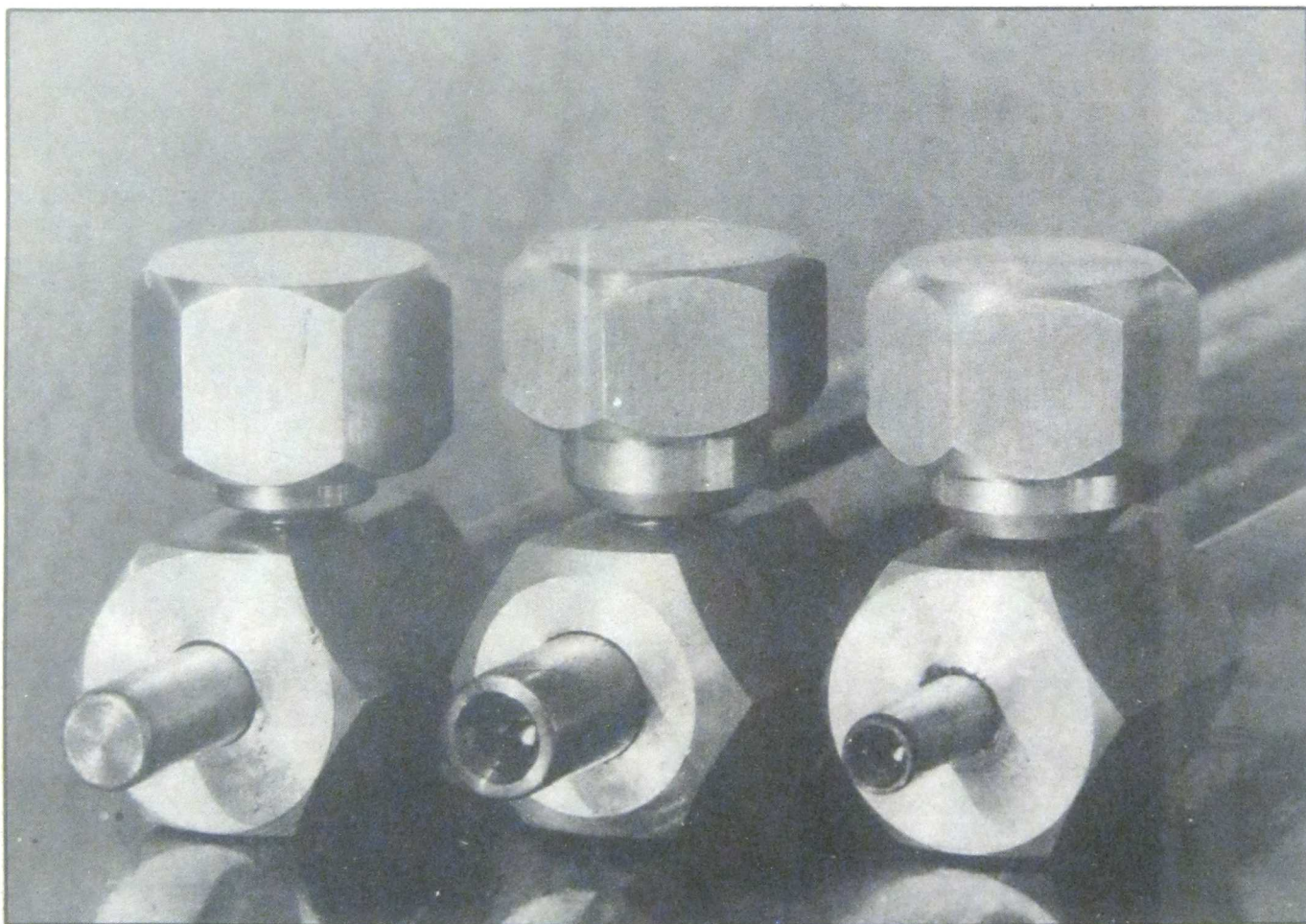
single hair on one pan and it would yaw wildly. The thorny problem, as I found, lay in finding something with which to calibrate it.

You might assume a five-grain aspirin tablet weighs five grains, hmm? No, as it turns out, they weigh somewhat more than that, perhaps due to inclusion of inert ingredients. A burnt paper match usually weighs a little more than one grain and a typical gummed cigarette paper weighs somewhere around one-tenth-grain, but none of these are reliable enough to risk your money upon.

When all is said and done, a good powder scale is a reloader's best friend. Given one of those, you can go on and exercise many crafty stratagems but, lacking one, you're running in the dark, never knowing where the clothesline awaits contact with your cringing Adam's apple. Were I starting into the reloading game today, knowing now what I didn't know then, I'd save up for a powder scale a lot sooner than I did.

FINE POINTS OF BULLET-SEATING

Details On A Simple Device, Easily Constructed, For
Measuring The Vital Relationship Between Bullet
Ogive And Rifling Leade To Obtain Peak Accuracy

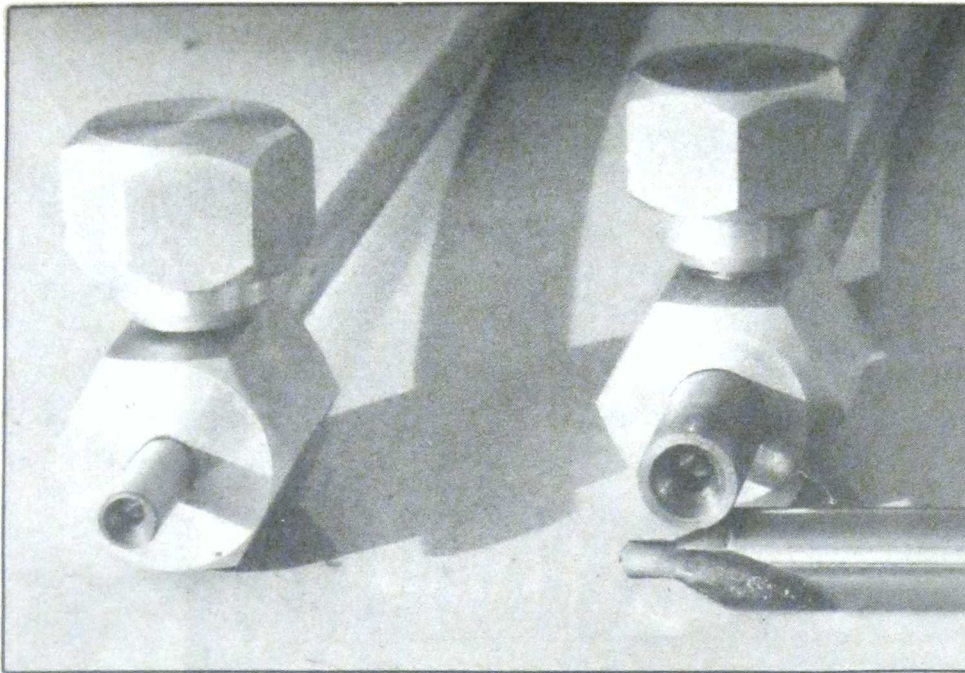


Three of the bullet-seating gauges, made up in various diameters. The one at left has its flat end showing and the other two show the countersunk ends. As discussed, I find it helpful to make them with both a flat and countersunk end for assorted applications. Locking knobs are of $\frac{1}{4}$ -inch aluminum hexagonal bar stock.

STUFFING THE BULLET into the mouth of the primed case, over the charge of powder, involves a lot of seemingly minor intricacies, several of which can affect the performance

rather significantly when it comes time to fire the resulting reload.

First, and quite possibly foremost, you must avoid exceeding some given amount of overall cartridge length so



Unit at right is shown with the countersink bit used to shape the 60° end cavity that enables the rod to make contact with the ogive of a jacketed bullet rather than the tip. Soft point bullets often are dinged on the tips and the cone provides a more accurate reference.

as to assure that the cartridge can be chambered and fired in the first place. Several factors apply here and most of them depend upon the given gun and cartridge. The critical consideration can be termed length overall and abbreviated LOA, or cartridge overall length (COL) or perhaps some other designation. Several have been used and others may be encountered. Let us arbitrarily settle upon LOA for the discussion at hand, okay?

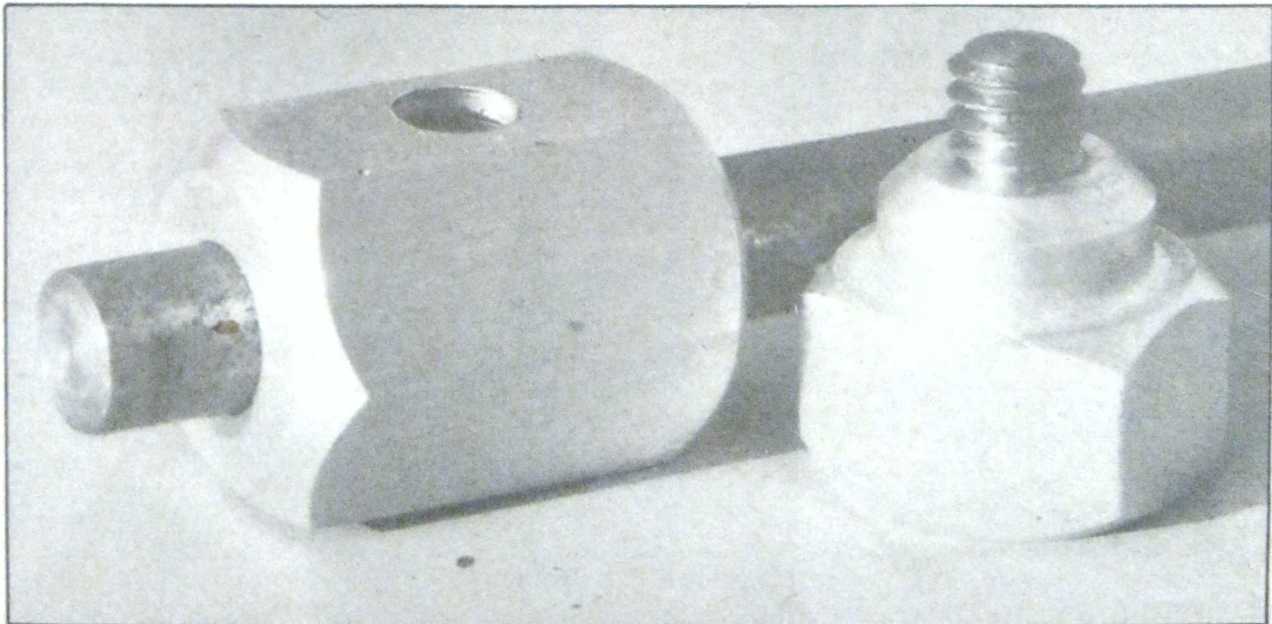
In revolvers, too much LOA lets the tips of the bullets protrude from the front of the chambers, effectively preventing cylinder rotation and tying up operation of the revolver like a heifer on a barbed-wire fence. Obviously, you want to avoid that. When reloading for revolvers, remain mindful that the forces of recoil tend to make the bullets want to migrate forward in the case mouth. We have

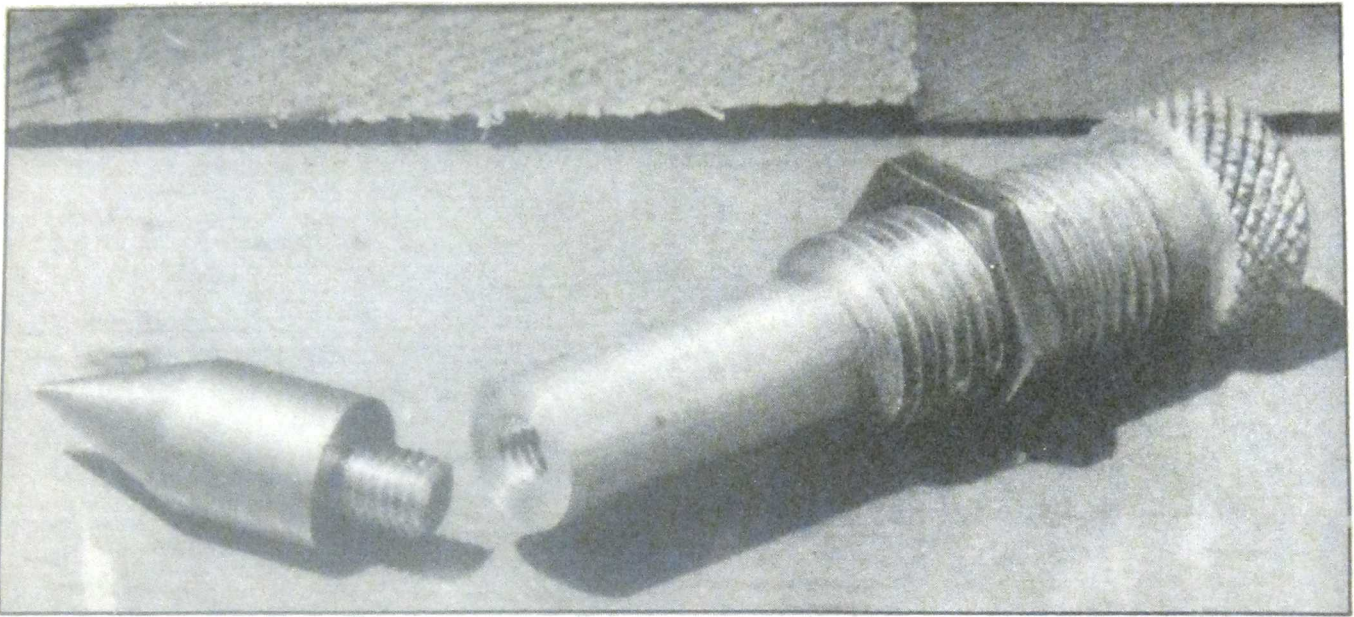
spoken — several times already — of the desirability of a tight grip of the case mouth against the bullet base. Given that, you have no problem. Lacking that, the most savage roll-crimp obtainable will not suffice. Not all data sources agree on this point. You may wish to determine the particulars on your own. In my own day, I felt the same and did just that.

When reloading for guns with detachable or integral box-type magazines, it is necessary that the LOA permit the cartridge to be loaded into the magazine and that it should feed up without hangups or interference. Again, that determines some manner of maximum LOA and factory loads in the same caliber usually can be relied upon to serve as references to determine the proper LOA.

What makes the entire matter so iffy and imprecise is the

Locking knob is turned to shape on the lathe, drilled with a #7 bit and tapped 1/4-20. A short piece of threaded rod is turned into the knob and sealed in place with Stud N' Bearing grade Loctite. A matching hole is drilled and tapped in the side of the sliding collar to accept the threaded end of the locking knob, as discussed in text.





The central stem of the Lyman Type M expanding die has a hole tapped 10-32. In addition to using these for homemade expanding plugs, one can also make up tooling for specialized bullet seating such as the one here.

variation from one gun to the next in the amount of nose-room ahead of the cartridge case mouth in its chamber. One term for that is *freebore*. The commencement of the rifling, or *leade*, is situated some given distance ahead of the front of the chamber, but the distance varies extensively from gun to gun.

A typical bullet is small in diameter for some portion of the front end, gradually tapering back to a point where it attains its full nominal diameter. Again, this varies with the make and model of the bullet and, sometimes, with the year of its manufacture.

For the moment, we are not concerned with revolvers. We are speaking of guns having a chamber integral to the bore, such as autoloading or single-shot pistols and practically any rifle you care to mention. Such guns are manufactured so that the rifling leade opens up to full bullet diameter some indeterminate distance ahead of the front of the chamber.

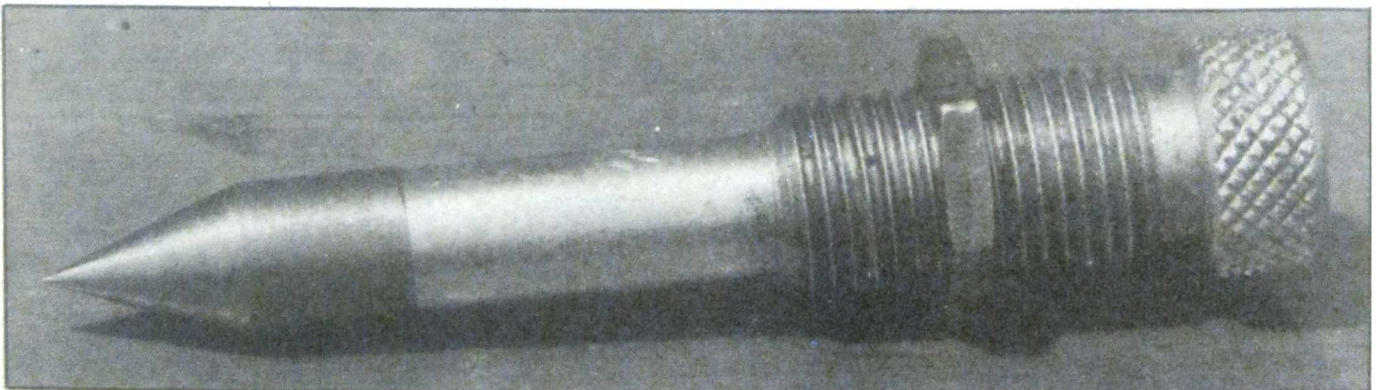
What we need to do is to determine that indeterminate distance, and it is that with which much of this chapter is concerned.

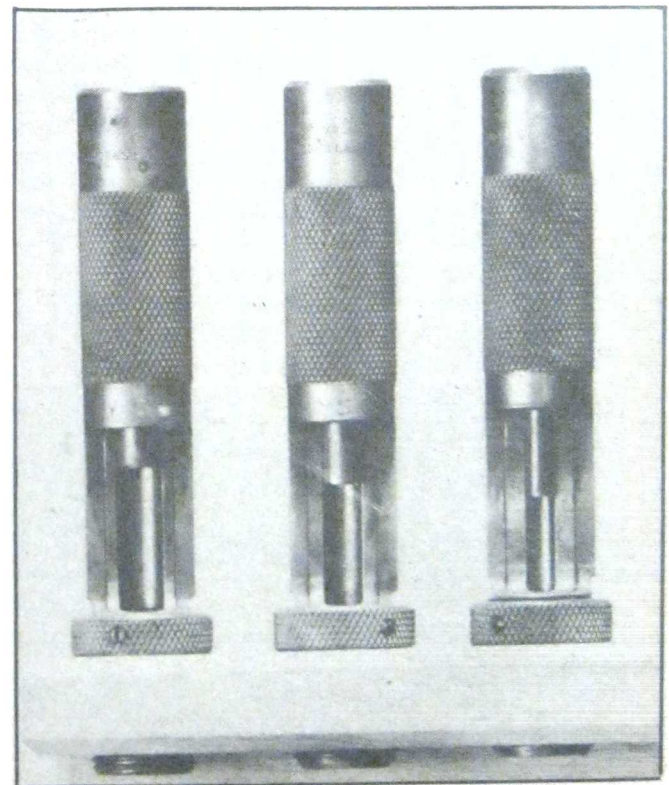
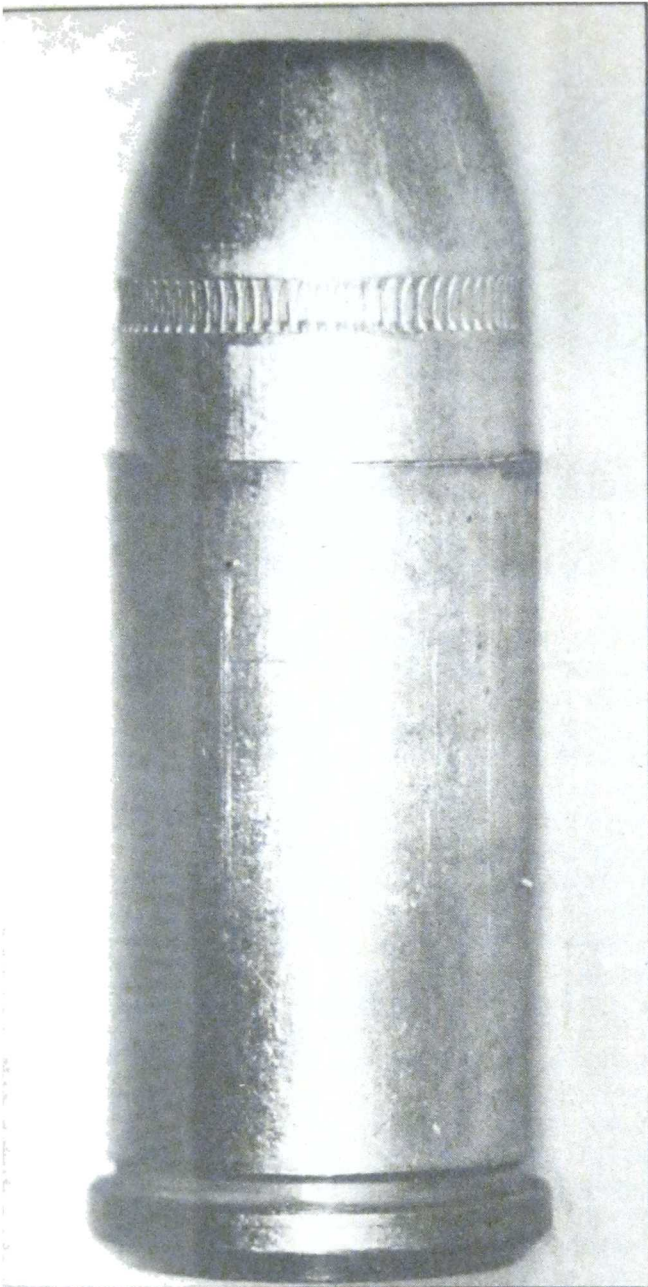
If the tapering foreportion — the *ogive* — of the bullet is tightly wedged into hard contact with the leade of the rifling it is obvious that a major amount of shove will be required to get it moving down the bore toward the muzzle. If the ogive is some slight distance short of intimate contact with the leade, it is equally apparent the bullet will have the opportunity to build up a small amount of momentum to assist it in engraving its jacket into the lands and grooves of the bore. In a typical example, the bullet will build up an impressive amount of velocity in its first eighth-inch or so of unimpeded travel.

As it appears, from observation of cause and effect, the bullet can be lightly in touch with the leade when chambered, and will take off and proceed without undue difficulty. The problem comes up when the ogive is brutally thrust into grinding contact with the leade prior to firing.

With all that firmly in mind, it becomes apparent we need some manner of determining the relationship of the ogive of the bullet of the chambered cartridge to the leade of the rifling and that is exactly what we propose to discuss.

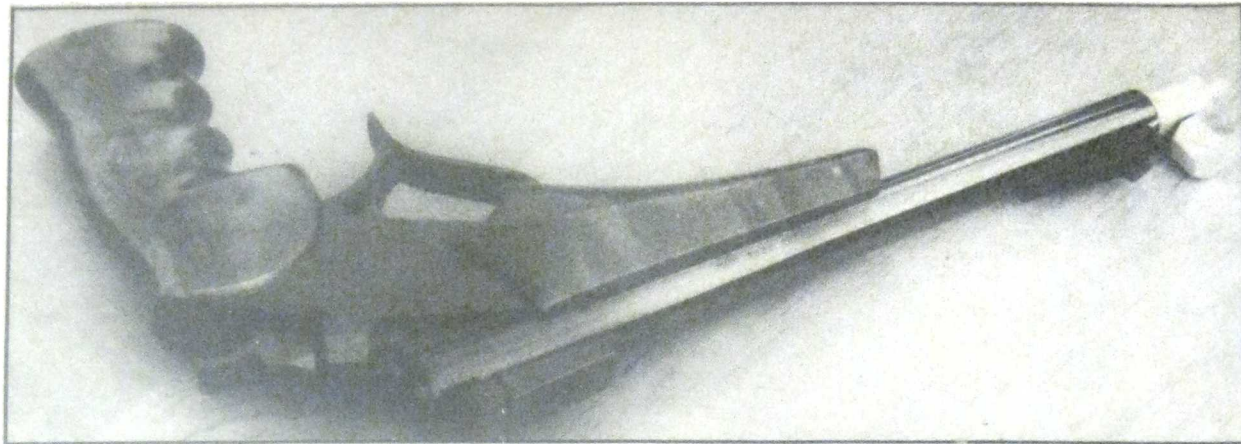
The same Lyman M die stem at the top of the page is shown assembled here. The short section of 10-32 threaded rod is turned into a matching hole in the punch and sealed in place with Loctite. This was made up for seating some of the homeswaged .44 JHPs with an exceptionally large nose cavity and it worked well.





Above left: This .45 Auto Rim case has about the proper amount of neck flare for seating jacketed bullets. You might want a bit more flare for cast bullets, but not a lot more. (Above right) Examples of the heavily crimped necks commonly found on factory loads. If the bullet is quite soft, such crimps can scrape its sides when fired. (Right) Three of the old Vickerman bullet seating dies in .35, .30 and .22 sizes. These were quite convenient, but are not currently available.

There are various approaches for obtaining the needed data. Observing precautions about to be discussed, you can "smoke" the bullet ogive and chamber the cartridge, then extract it and examine the ogive for traces of contact with the leade. A common cigarette lighter, delivering a good-sized flame, will smoke a cold metal surface nicely if it's held at the upper tip of the orange flame. If you're doing this with a live round, be extremely aware of the hazard of overheating and igniting the powder charge. If you wish to be super-safe, make up a dummy round, without powder or



Here, the flat end of the rod has been moved to touch the standing breech (with the action closed) and the collar was locked in place with its rear face touching the muzzle. The given bullet can be inserted from the breech and pushed with a rod to make light contact with the rifling leade. With that done, the distance between the rear of the collar and the muzzle is the maximum LOA of the loaded round, quite easy to measure.

live primer, and smoke it lavishly before trying it in the chamber. If you can see marks of the lands on the sooted ogive, seat the bullet a little bit deeper, smoke the ogive and try it again.

There is another approach, substantially more precise, but it involves — for the present — making up a gizmo that doesn't seem to be on the market. It accepts and incorporates each and all of the individual characteristics of the bullet and gun with which you're concerned and it works extremely well. As noted, the problem is that you'll have to make your own because no one will do it for you and (sigh!) it's highly probable no one ever will. It's one of my own little inventions and those seem to be sort of doom-ensorcell'd from the word go. Like the K-Spinner, y'know...

It isn't terribly hard to make. It helps if you have a drill press and it helps even more if you have a metal lathe or access to one of those glorious artifacts. You will need a length of cold-rolled bar stock about 1 1/2 inches longer than the distance from muzzle to bolt face or standing breech and small enough in diameter to go down the bore. That means 3/16-inch for caliber .22 and 6mm; 1/4-inch for .25, .264, .270, 7mm and .308-inch; 5/16-inch for the sizes from there through .358-inch; 3/8-inch for the sizes on up to caliber .44; and 7/16-inch from there on up. You can use half-inch for .600 Nitro-Express.

You will need to make a friction-locking stop-collar to lock securely at any desired point along the length of the rod. You will need to face one end of the rod off flat and it

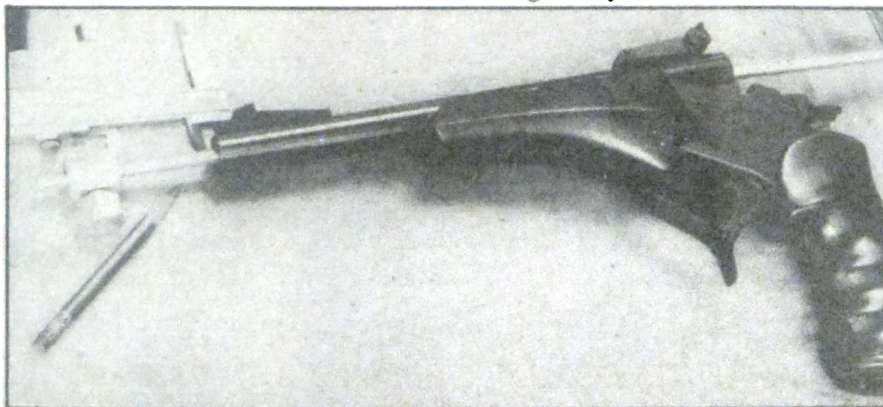
will be immensely helpful if you can put a suitably sized countersink hole in the other end of the rod, as illustrated on the sample.

WARNING: *Use of the bullet-seating guide rod discussed here may involve its insertion down the bore over a live cartridge in the chamber. In that event, scrupulous observance of safety precautions are absolutely mandatory. If the cartridge should fire with the rod in the bore, extremely hazardous and downright cataclysmic results will ensue. The reader/reloader is urged to make up dummy rounds, without powder or live primers, to use in the testing as described!*

In point of fact, the inspiration for invention of the guide rod was that I was working with the 7mm T/CU cartridge in the Thompson/Center Contender pistol. I was trying to coax it into grouping less than one minute of angle (MOA) at one hundred yards — under 1.05 inches of extreme center-to-center spread, that is — and I needed all the help I could connive to get. As it turned out, in that particular application, I got my best groups when the bullet ogive was just barely “kissing” the leade of the rifling. I doubt if that would prove true in all other applications, but the guide rod proved to be of great assistance on the 7mm T/CU project and I did manage to crack the MOA barrier with a good margin to spare.

When working with the Thompson/Center Contender, it is a simple matter to observe safety precautions to prevent an accidental **discharge**: All you have to do is to avoid

This photo further illustrates the procedure described above. The rod at right is a separate piece, pressing lightly against the base of the given bullet.



Maximum LOA - .32-20 Contender			
Hornady #3205	1.700"		
Winchester #B32AP	1.764"	(.3115" dia.)	
Hornady #555	1.800"	(.3075" dia.)	
Speer #1845	1.814"	.3076	
Sierra 110gr 20 M-1 Can	1.915"	.3080	
Speer #1235 Can	1.785"	.3080	
Speer 110gr 3085-11005-SP	2.060"	.3085	
Sierra 110gr 308HP	2.022"	.3080	
Speer #1855	2.048"	.3082	

It was only a few minutes' work to determine the maximum LOA for a series of bullets for use in the .32-20 WCF Contender barrel.

cocking the hammer. With a bolt-action rifle, it's another matter entirely, which was the reason for the italicized reminder, two paragraphs back.

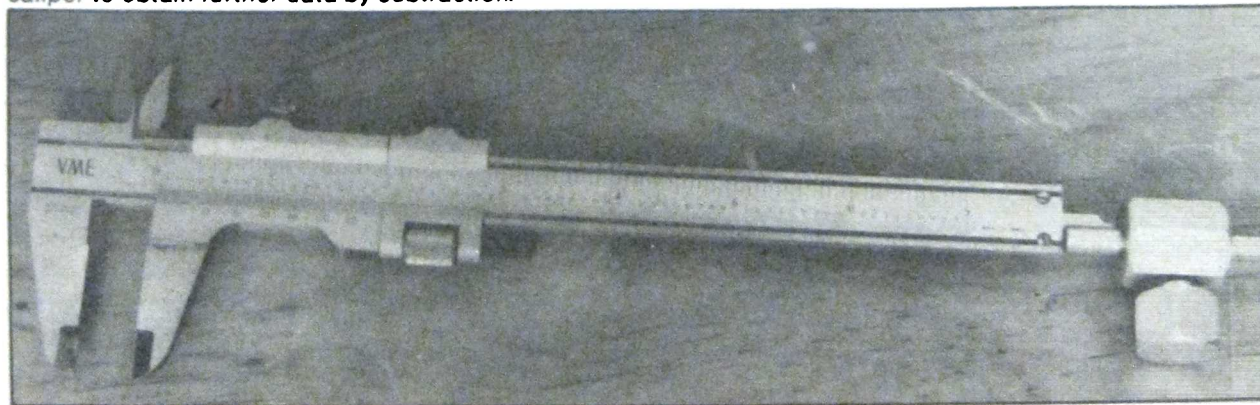
I noted that the rod should be made up with one end flat and the other countersunk. The countersunk end can establish a reliable measurement upon the last of the ogive. When working with JSP bullets, minor distortion of the exposed soft tip can throw you off on the measurements, but the countersink, applied to the ogive, gives a pretty reliable measurement. The flat end, as we shall see, has its useful applications, too.

To determine the effective amount of freebore — distance from ogive to leade — seat the bullet to a tentative depth and see if it will chamber. If it won't, seat the bullet a bit deeper until it will chamber. Run the counterbored end of the rod down until it makes snug, solid contact with the bullet ogive at the tip. Loosen the locking screw on the collar and, holding the rod against the bullet tip, slide the collar into contact with the muzzle and tighten it in that setting with the locking screw.

Remove the chambered test cartridge and substitute another (consider using a dummy) holding the same bullet, seated well out so its bullet will touch the leade and stop. Holding it in that position, slide the countersunk end of the rod down to touch the tip of the bullet and note the distance between the rear face of the collar and the muzzle of the barrel. That is your exact amount of freebore, as discussed previously.

Still holding the bullet against the leade, reverse the rod and run the flat tip of it down to touch the bullet tip. You'll need to loosen the collar, of course. When it touches the

This shows how the amount of rod protrusion can be measured with the depth gauge of a vernier caliper to obtain further data by subtraction.



bullet tip, move the collar against the muzzle and tighten it at that setting.

Now take a caliper and use its depth gauge to measure the distance from the front of the collar to the end of the exposed rod, making note of the measurement. Remove the cartridge from the chamber, close the action, loosen the collar and push the rod down until its flat end touches the bolt face or standing breech. Tighten the collar again and use the caliper depth gauge to measure the amount of rod protruding ahead of the front surface of the collar. Record that measurement.

By simple subtraction of the small dimension from the large one, we arrive at the actual LOA for that bullet, in that gun, that will put the ogive precisely into gentle contact with the leade. The dimension can be set up on the caliper and locked in its setting so the bullets can be seated to just that length.

Alternatively, with the just-touching dimension established, you can go on to make up loads shorter than that by any suitable amount and test them off the bench in comparison to the loads made up at maximum LOA. I can't tell you which LOA will give the best groups, but your gun will make its prejudices clear if you give it half a chance.

In making up the bullet-seating guide rod, you'll want the piece of rod long enough to project for half an inch or so beyond the front surface of the collar when the rod is completely inserted into the empty chamber, with the action closed. It is an easy matter to measure the amount of protrusion with the caliper depth gauge and, by suitable subtraction, you'll be able to obtain the desired dimensions to within .001-inch or so. The beauty of the system is that it bypasses all the manufacturing tolerances and assorted other variables and tells you exactly what's what with that given gun and the bullet under consideration. I know of no other approach that does it as well, or so simply.

A scaled-down version of the same device can be used for controlling the LOA in auto pistols, often to excellent effect. You may be tempted to merely shove a bullet up against the leade by itself, but if it's seated in a case, it will be centered more accurately and the resulting dimensions will be more valid. I'm referring to the bullet you seat well forward for determining the point at which the ogive touches the leade.

In auto pistols, you will want to seat the bullets with at least a little freebore or jump so as to assure reliable closure of the action into battery. Naturally, you'll also need to make certain the LOA is short enough to assure easy loading into and feeding out of the magazine.

HEADSPACE AND RELOAD PERFORMANCE



Here are the five basic head designs used on cartridge cases. #1 is a .348 Winchester, a typical example of the rimmed head. #2 is the .308 Winchester, a typical rimless head. #3 is the .220 Swift, a semi-rimmed head. #4 is the .350 Remington magnum, typical of the belted-magnum head. #5 is the .284 Winchester, one of the few examples of the rebated head. Both the .284 Win. and .225 Win. — a rimmed case — are popular as the parent brass for wildcat cartridges, but not overly popular in their original format; a state of affairs that must puzzle engineers at W-W!

HEADSPACE is a term that seems to awe and mystify a number of reloaders, perhaps because they just don't quite understand what it is. Any confusion surrounding that can be

cleared up quite easily. Think of headspace as the amount of front/back movement or end-play possible for the cartridge to make when it is locked into the chamber and ready to be fired.

The Cartridge Case Needs To Nestle In Its Chamber, All Fitting And Proper. Here Are Some Observations Concerning Cases

Keep in mind, also, that the blow of the firing pin against the center of the primer tends to drive the cartridge as far forward into the chamber as it can go. The powder, after ignition by the primer, burns and builds up pressure and that, in turn, tends to cement the cartridge case to the chamber wall, until such time as the pressure subsides as the bullet leaves the muzzle.

A further complication is the matter of manufacturing tolerances. Dimensions of chambers vary for the given cartridge; some tight, some loose, the rest somewhere in between. A factory cartridge has to be small enough in all its major dimensions to chamber and fire in any firearm stamped to handle that caliber. All that is particularly true of military ammunition which, as Elgin Gates pointed out, writing in the IHMSA journal, *The Silhouette*, never is

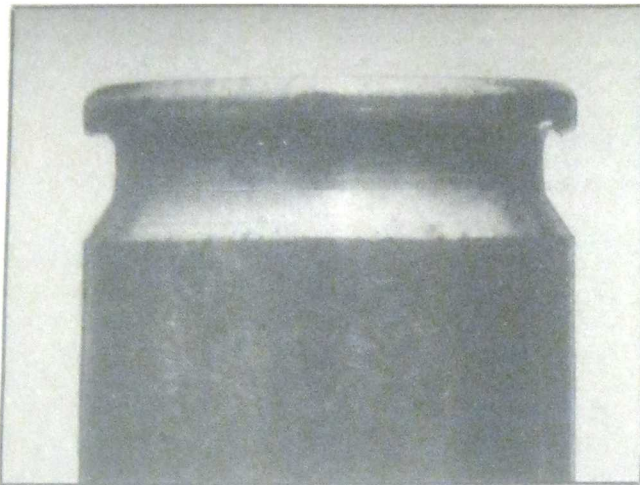
produced with any consideration of the possibility that someone, somewhere, someday, might wish to reload the fired cases. It is assumed the spent cases will fall to the jungle floor, the desert sands, the snows of the Arctic or wherever and vanish from the ken of mortal man.

Accordingly, the case wall ahead of the solid case head usually shows a substantial bulge where gas pressure forces the undersized case out to make contact with the oversized chamber. Both cartridge and chamber can be presumed to fall within permissible tolerances as to dimensions but the military thinking tends to prize a comfortable amount of clearance for the sake of reliable firing, even under difficult conditions of dirt, sand, dust and firing residues.

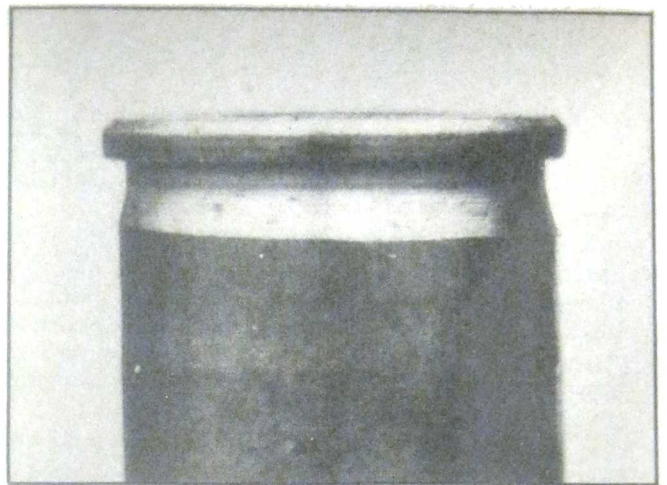
Chambering dimensions for bottleneck cartridges usually specify what they call a *datum line*, located at some pre-



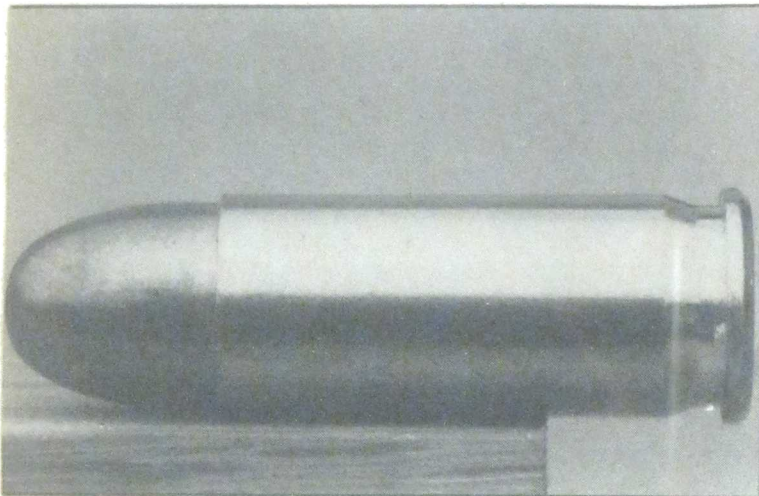
As discussed above, case walls expand out to meet chamber walls when fired. Near the head, the brass is thicker and expands but little. It's readily visible in the two standing cases at left. They were converted into impromptu .41 mag cases from .30-30 brass in early 1964 when I had a Model 57 S&W but, as yet, no factory .41 mag ammo. For comparison, a regulation .41 mag is at right.



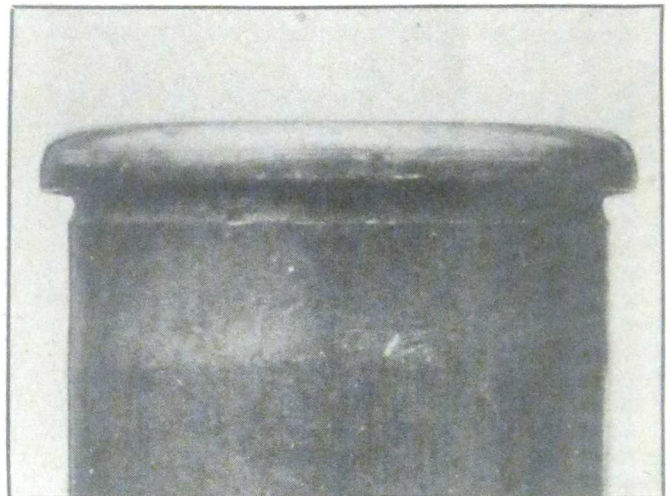
On this page, we take a closer look at the various case head designs. This is the common rimless, in which rim diameter is closely equal to the diameter of the case ahead of extractor groove.



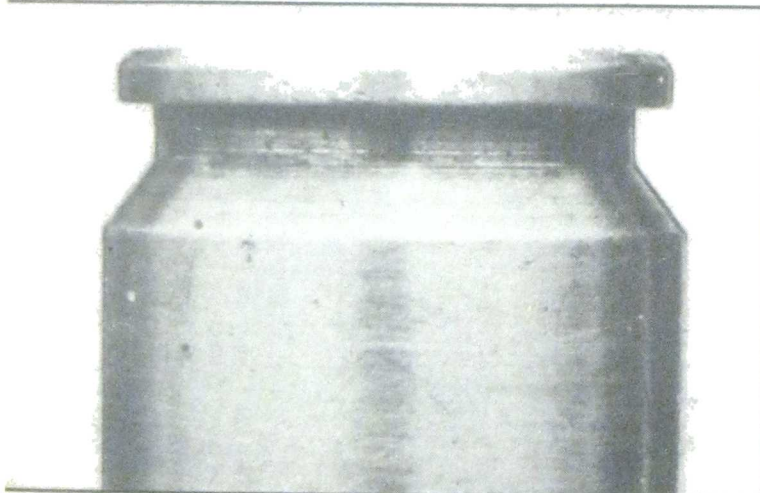
A closer look at the .220 Swift head and rim.



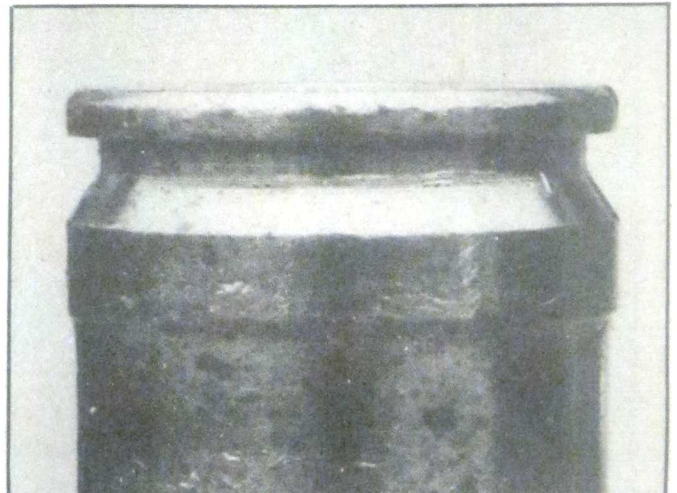
The .38 Colt Super, like the .220 Swift, is a semi-rimmed design. It can be chambered in .38 Special revolvers but, if fired, will wreck the gun.



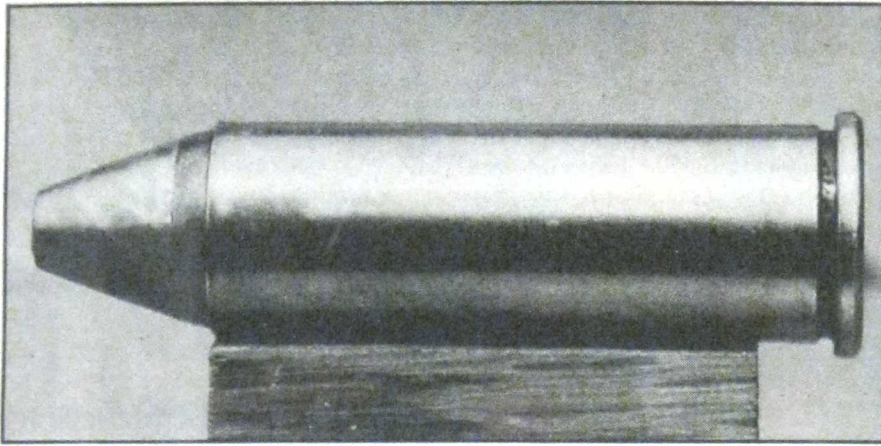
The .348 Winchester, like the .44 magnum at the top of the facing page, is fully rimmed. Note both provide a groove between case wall and rim face. This is a common practice.



The rebated .284 Win. has the same head dimensions as the .30/06, though body diameter is greater, bypassing bolt face modifications.



Theoretically, belted-mag cases headspace on the front ledge of the bolt. As discussed elsewhere, shoulder tolerances will vary.



The .44 magnum has a sturdy rim to support it and does not need headspace on the case mouth; body is untapered.

cise point about midway of the shoulder, the distance from that back to the case head is specified, with some amount of plus or minus variation being considered acceptable.

Suppliers of gunsmith equipment, such as Brownell's or B-Square, offer headspace gauges (frequently spelled gages in this context) for checking chambers. Usually, these are supplied in pairs consisting of a *go* and *no-go* gauge. Machined from steel to a high degree of precision, the gauges resemble the cartridge case.

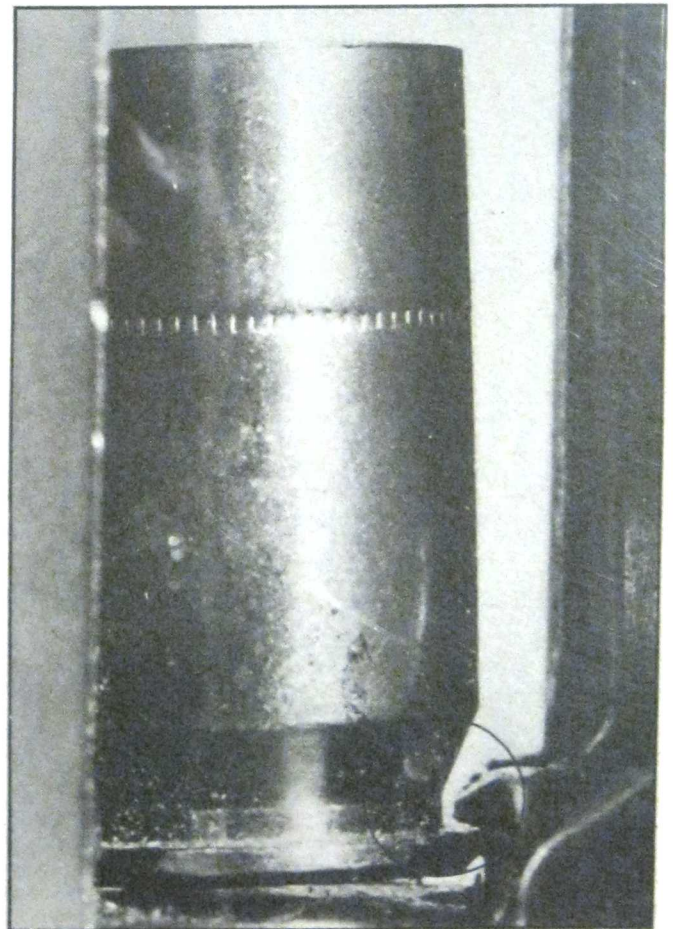
Fed into the chamber in the same manner as a cartridge, the *go* gauge should permit the action to close without appreciable difficulty. On attempting to chamber the *no-go* gauge, the action should not close.

Cartridge case designs can be divided into four basic categories: rimless, in which the rim is the same diameter as the body of the case across the extractor groove from it; semi-rimmed, in which the rim is only slightly larger; rimmed, in which the rim is substantially larger; and belted-magnum, where a slightly larger head diameter extends for some short distance ahead of the extractor groove. A fifth variation is the rebated head, in which the rim is slightly smaller than the large end of the case, as exemplified by the .284 Winchester cartridge.

Here's an empty .45 ACP case with its rim in contact with the extractor. As discussed here, this may be the only support the cartridge gets at time of firing because nearly all such cases are too short to touch the chamber ledge that many have been told offers headspace support.

The .45 ACP is an example of the true rimless case. The .38 ACP and .38 Colt Super represent the semi-rimmed, as does the .220 Swift. The .30-30 WCF and .38 Special are typical examples of the rimmed case and the 7mm Remington magnum or .300 Winchester magnum represent the numerous examples of the belted-mag head design.

In any of the different types, something has to support or hold the case in place against the slam of the firing pin against the primer. It is widely assumed the chamber ledge supports the case mouth of a rimless cartridge to provide headspacing support. All that will be discussed at greater



length toward the end of the present chapter but I will note here that it appears, more often than not, the extractor is what actually holds the .45 ACP round in place for the buffet from the firing pin and yes, with that in mind it's remarkable how accurate some of them can be!

Some of the semi-rimmed cases such as the .32 ACP, .38 Colt Super and the like provide chamber ledges for the vestigial rim, with a chamber ledge that may or may not make contact with the case mouth, depending to a large extent upon who made and chambered the barrel.

The rimmed cases headspace against the rim as it rests in the chamber, at least for the first firing of cases such as the .30-30 WCF. Virtually all revolvers headspace on the rim and some amount of clearance is provided intentionally to prevent interference to cylinder rotation.

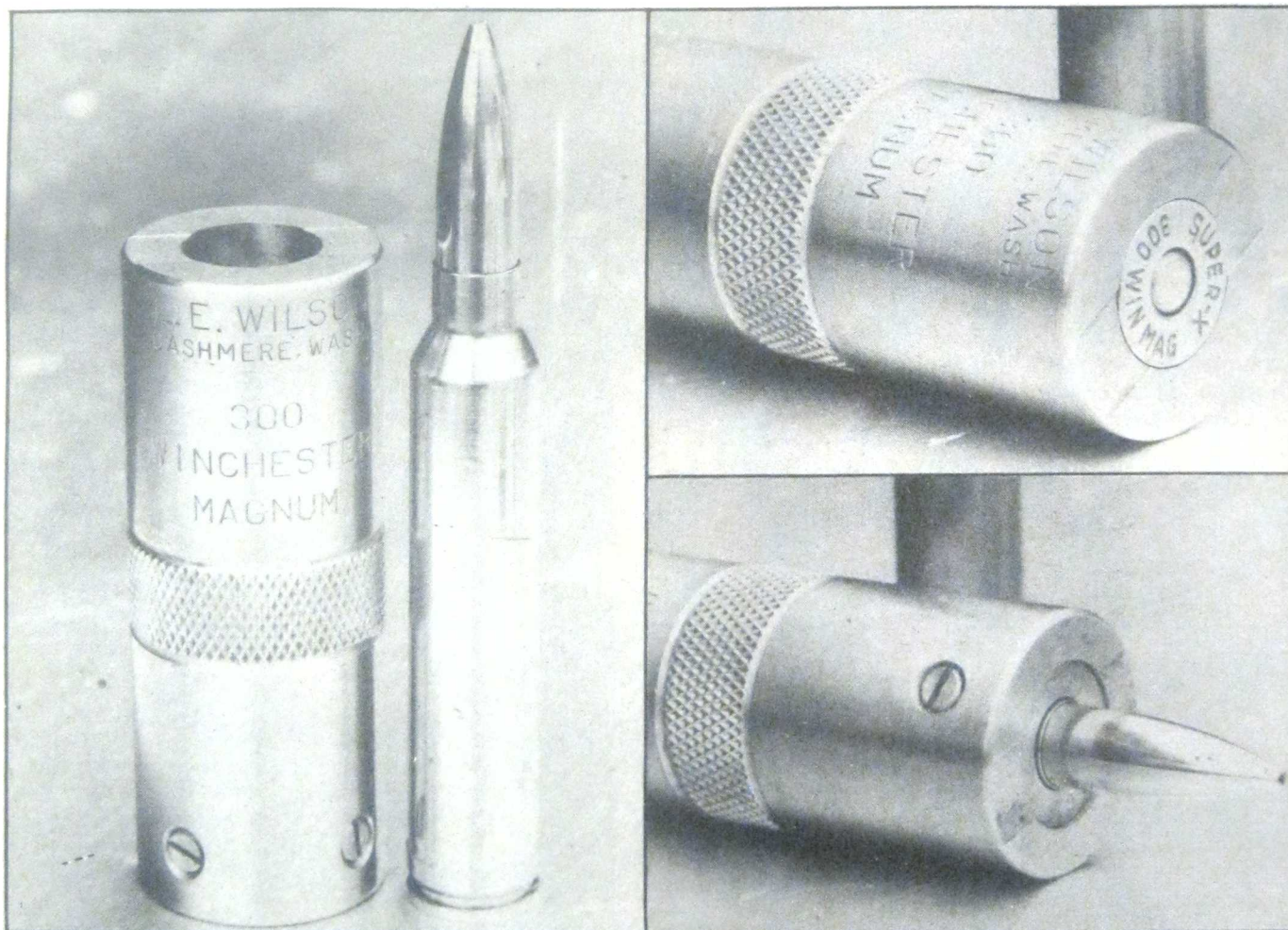
The belted-mag cases headspace by a fit of the front surface of the belt against a ledge in the chamber and do so quite precisely. As most of those are bottlenecks, the clearance between the shoulder and its mating surface in the chamber may show considerable clearance at the first firing. If so, it results in the shoulder being moved forward a significant distance. If the case resizing die is turned down in the press to make snug contact with the top of the shell holder, it may result in a substantial set-back of the shoul-

der in resizing and, when fired, it blows forward again and so on. The result is excessive movement or "working" of the shoulder, weakening the brass and shortening the useful reloading life of the case.

To counteract the problems just covered, L.E. "Sam" Wilson of Cashmere, Washington, developed and produces his adjustable case gages (which is how Sam spells it, quite correctly) for use with the belted-mag calibers. The part of the gage that touches the shoulder is a separate piece, locked in place by three set screws. In use, you insert a fired case from the given rifle into the gage, loosen the set screws, move the shoulder piece into snug contact and retighten the screws to hold it at that setting.

With that done, the resizing die can be adjusted so the resized case, when reinserted into the gage, does not allow the head to enter beyond being flush with the surface of the gage head. Assuming you use the same press for loading that cartridge at all times, it is a simple matter to snug up the locking collar on the resizing die good and securely, after which you are fairly well set from then on.

On the rimmed bottleneck cases, such as the .30-30 WCF and the growing group of wildcat (not factory standard) cartridges made from it, it is held highly desirable to use somewhat the same techniques to adjust the resizing



L.E. Wilson's adjustable headspace gauge, illustrated here in three views, offers nearly the only way the reloader of belted-mag cases can adjust the full-length resizing die so as to minimize excessive "working" of the shoulder area. With headspacing handled by the belt, shoulder chambers vary more than with rimless cases and precise shoulder placement is important to assure long life for the brass.

die in order that the rounds headspace against the shoulder area of the chamber, rather than against the front of the rim. This gets to be a pretty finicky operation when reloading for the Thompson/Center Contender pistol in .30-30 WCF or its derivative rounds such as the 7mm International Rimmed (Int-R), .30 or .357 Herrett and the like.

The Contender, you see, offers only a moderate amount of camming action in getting the action closed. If the cartridge has a trifle too much headspace dimension, it functions much in the manner of a no-go chamber gauge. In borderline examples, the action may seem to close in readiness for firing, but a mechanical block built into the action will prevent it from actually setting off the cartridge and the hammer will come to rest in its usual uncocked position instead of moving on forward to strike the firing pin.

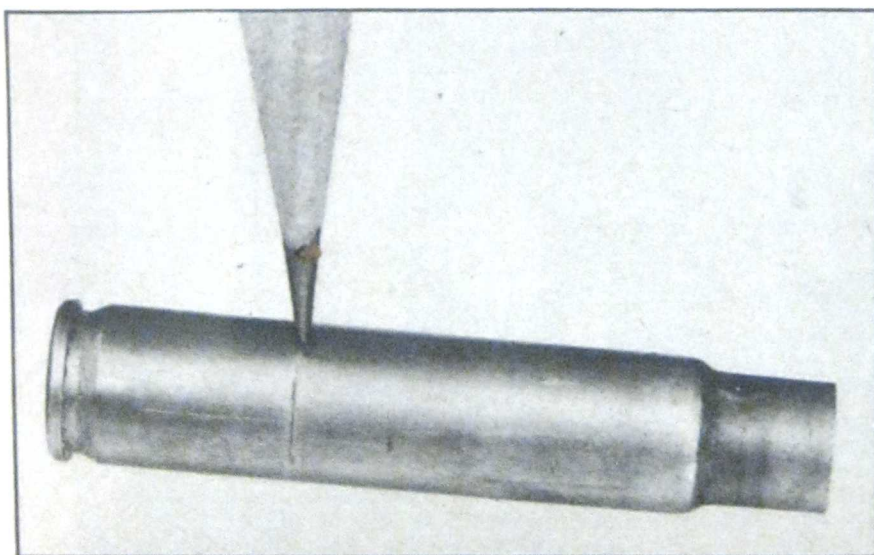
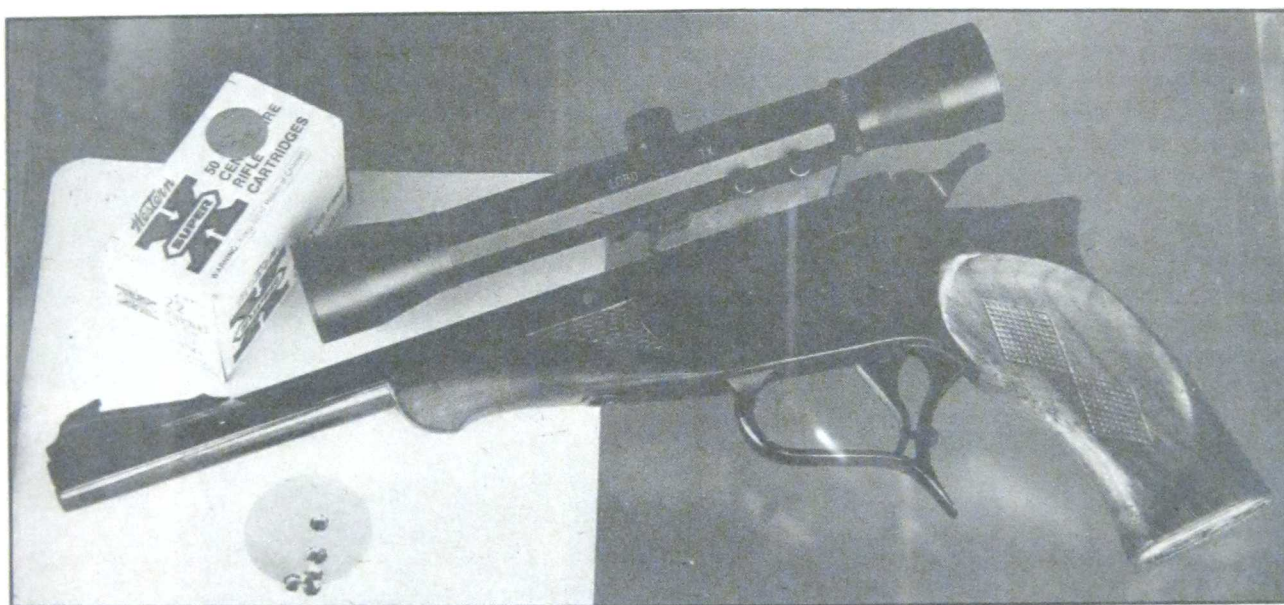
The business of "tuning" the adjustment of the resizing die for a bottleneck case to be used in the Contender requires some considerable amount of care and patience

and it helps if you're in a position to make up a round and try it to see if it works as you'd intended.

If you set off a primed, otherwise empty case in the Contender, it tends to be shortened in headspace by a substantial amount, assuming the primer fires. That is not due so much to the impact of the firing pin against the primer as to the force of the primer exerted on the vertical face of the primer pocket around the flash hole.

Bottleneck cartridges having only a slight amount of shoulder, such as the .35 Remington or the 7mm T/CU may pose more than their usual share of problems with headspace that gets too short for proper support of the cartridge in the chamber. Again, once you get a shoulder nicely established in its proper location, you want to avoid setting it back again by injudicious adjustment of the resizing die.

In some instances, it may prove helpful to seat the bullet out slightly, so as to make contact with the leade of the rifling, to provide added support for the cartridge in the chamber. By so doing, you may be able to get a good



Although the .22 Hornet is a notorious case-separator in some of the old rifles with lugs at the rear of the bolts, it's no problem in the Thompson/Center Contender, above. That's a 50-yard group and by no means the best I've ever had from that specimen. (Left) The 7mm TC/U is supported by a scanty shoulder up front and getting the resizing die adjusted so as to get both reliable firing and no stretching of cases is a real challenge. Pencil points to visible line of incipient separation in this 7mm TC/U case.

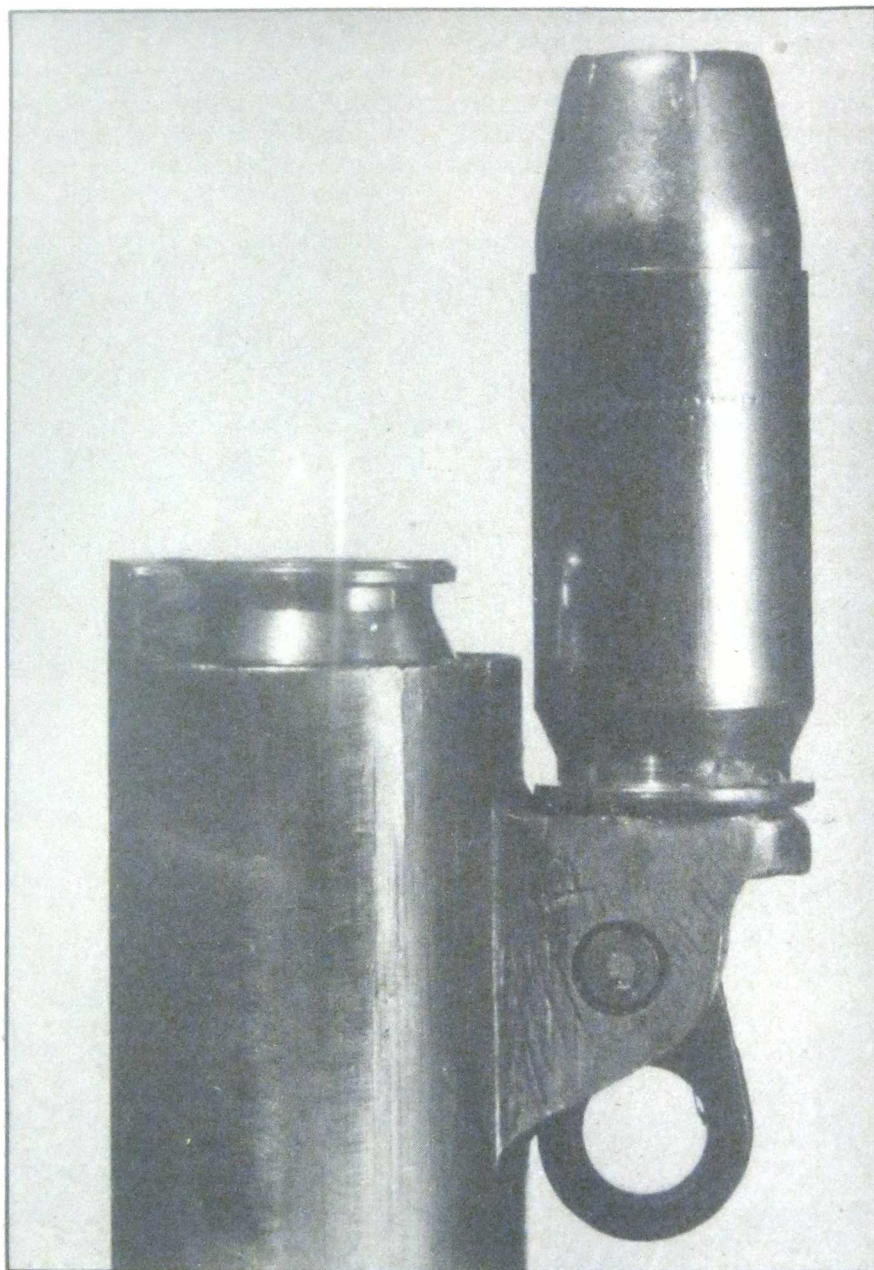
"proof" of the shoulder to the mating area of the chamber. It also helps if both the shoulder and chamber are free of foreign matter and residues in the critical area. In the example, the powder charge should be only moderate, not at the maximum listed levels.

Most makers of reloading dies offer a special neck-size-only (NSO) resizing die, complete with decapping pin and mouth expanding plug on the inner rod. Provided the previous load was not made up to what a friend who used to be a member of a string ensemble at the University of Minnesota was fond of terming "Gopher Baroque" loads, a pass into the NSO die will leave the case ready to be primed, charged and fired with a bullet. If fired at max-

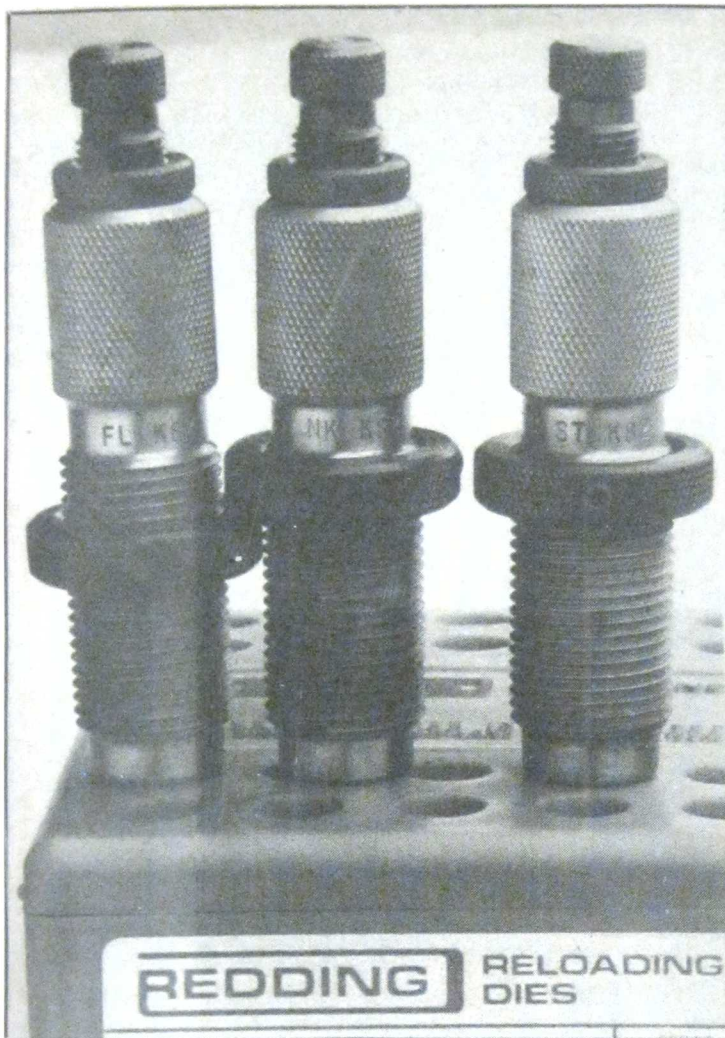
imum pressure, it may or may not require a pass into the usual full-length resizing die to restore the case body to rightful dimensions.

You will want to apply a tiny, *tiny* amount of sizing lube to the case neck for use in an NSO die, perhaps a little more inside the neck to ease the passage of the expanding plug or button; no lube at all on the shoulder, to prevent dents and deformation there. After a pass into the NSO die, wipe the lube off, of course.

The benefit of the NSO die is that it tends to leave the case body a nice fit inside the chamber. Needless to say, this works best if the cartridge is fired in the same chamber, time after time.

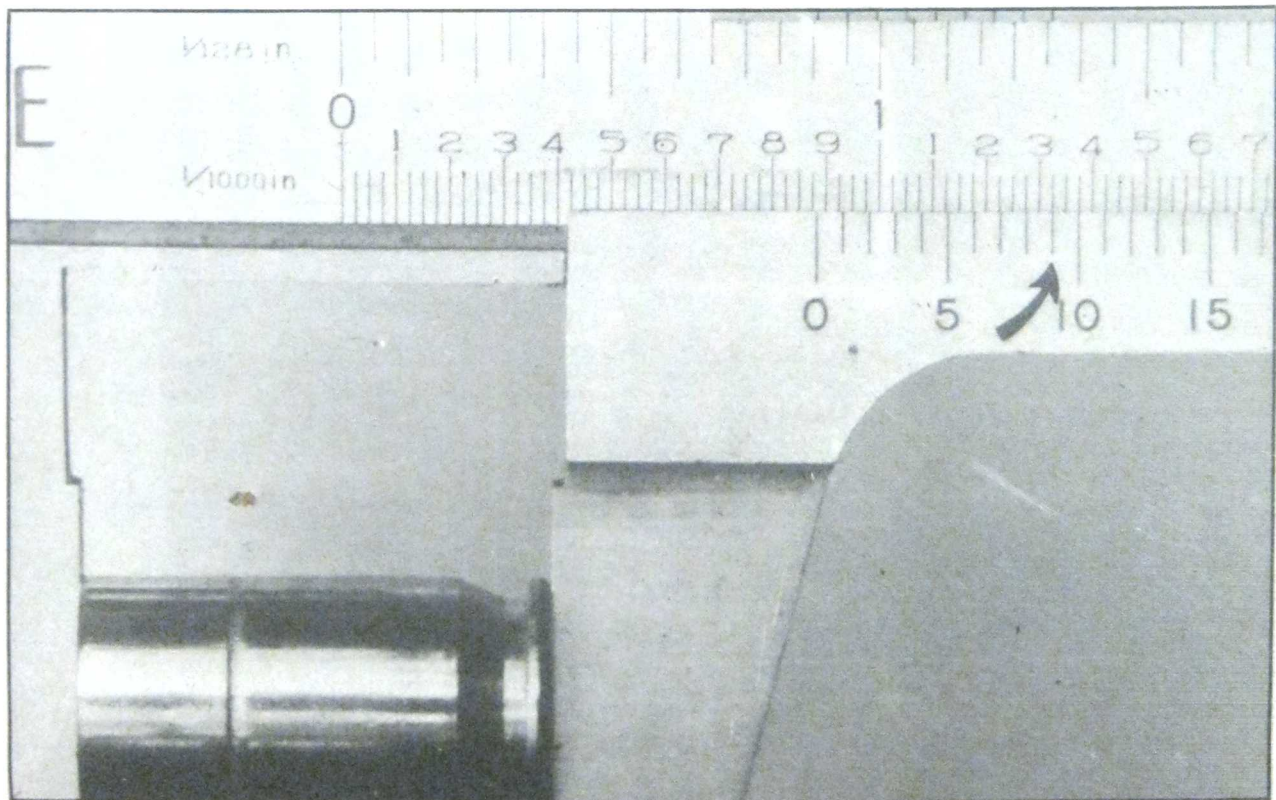


Here's another possibility for getting the .45 ACP round supported up front, where it's supposed to be, instead of by precarious clutch from the extractor. The bullet has been judiciously seated out to put its full-diameter portion into engagement with the leade of the rifling so as to provide dead-perfect alignment between the case head and rear surface of the barrel shroud. This requires a lot of trial-and-error experimentation to hit the happy compromise between accuracy and reliability!



At left is a three-die set from Redding in 7mm International Rimmed, with a regular full-length resizing die, a neck-size-only die and a seating die. Since most guns for the 7-R are of top-break design, with little muscle for chambering, rounds loaded with the NSO die can pose problems, but it's a pleasant concept, withal.

A typical .45 ACP case in the vernier caliper, showing a net length of .875 plus another .009 for a total of .884, which is a fat .014 short of the case length blithely quoted in the books. You'll have to rely on the extractor to position this one for firing, as is the case with nearly all .45 ACPs.



A nice, close fit as to headspace never hurts anything, unless it gets so snug as to prevent the action of the Contender from being closed fully, as noted. Much more often than not, a good job of headspacing improves the accuracy in a manner most astounding but gratifying. A salient example of that is the .38 Colt Super cartridge in one of Irv Stone's Bar-Sto barrels. Stone, you see, cuts the chamber ledge exactly where he figures it belongs and as it usually turns out, he's not far off enough to worry about. As a result, groups out of a Bar-Sto barrel can end up one-tenth the size of those where the case is supported by the skimpy rim or perhaps by the extractor.

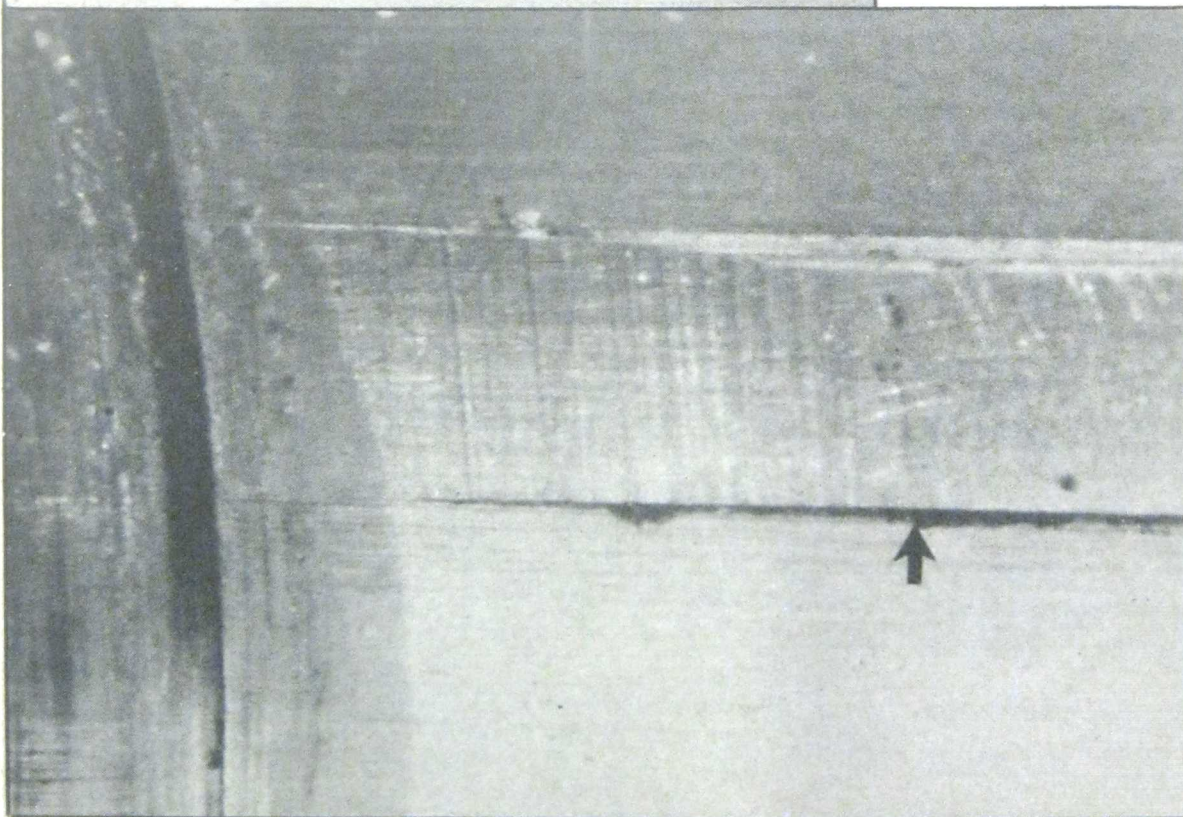
Old friend Claud S. Hamilton, a retired colonel of Field

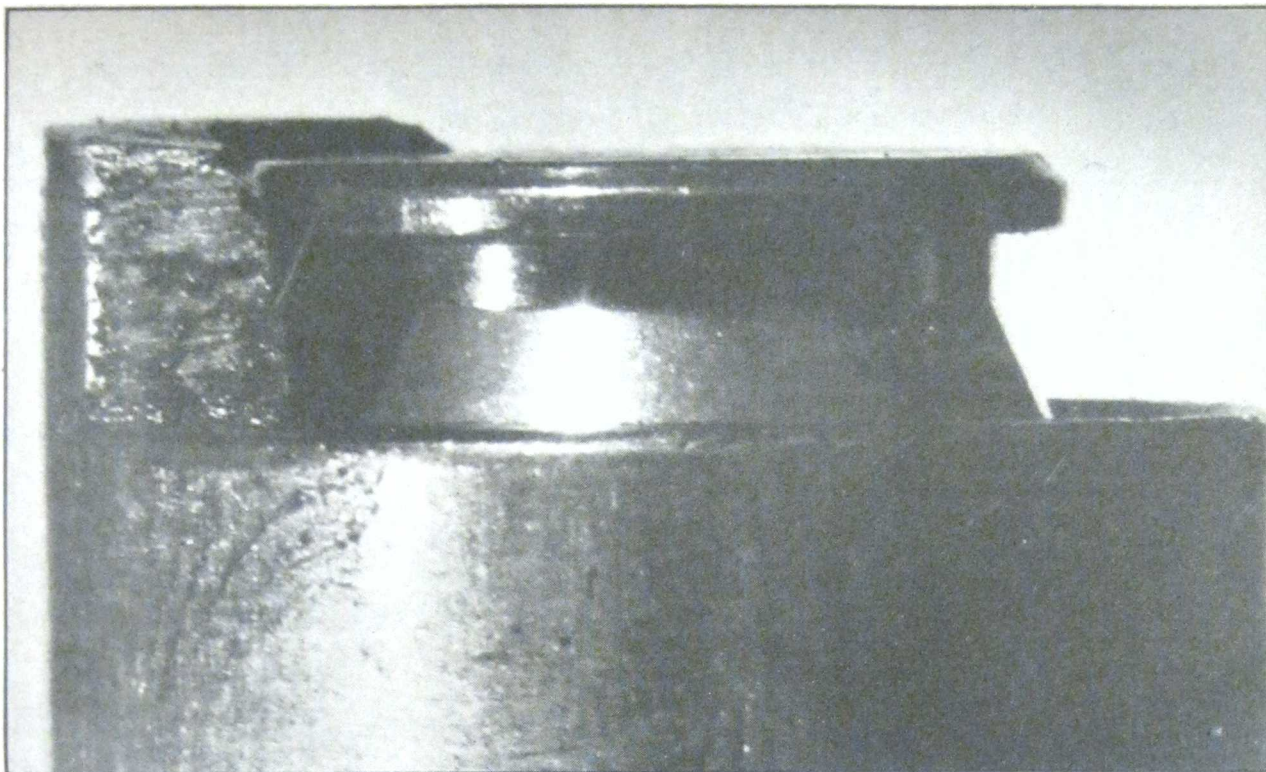
Artillery and better known as The Red Laig to his intimates, has put in a considerable amount of research on the matter of headspace and the .45 ACP cartridge. We've often encountered the statement that "The .45 ACP headspaces on its case mouth, so one should never apply a rolled crimp to its case mouth because that would deprive it of necessary support at that vital point."

After reviewing Hamilton's reports and comments, it is hoped that you may come to share his and my healthy skepticism as to the validity of that theory. Ladies and gentlemen, I hereby relinquish the microphone to Hamilton, aka the Sage of Staffordstrasse for the remainder of the present chapter.

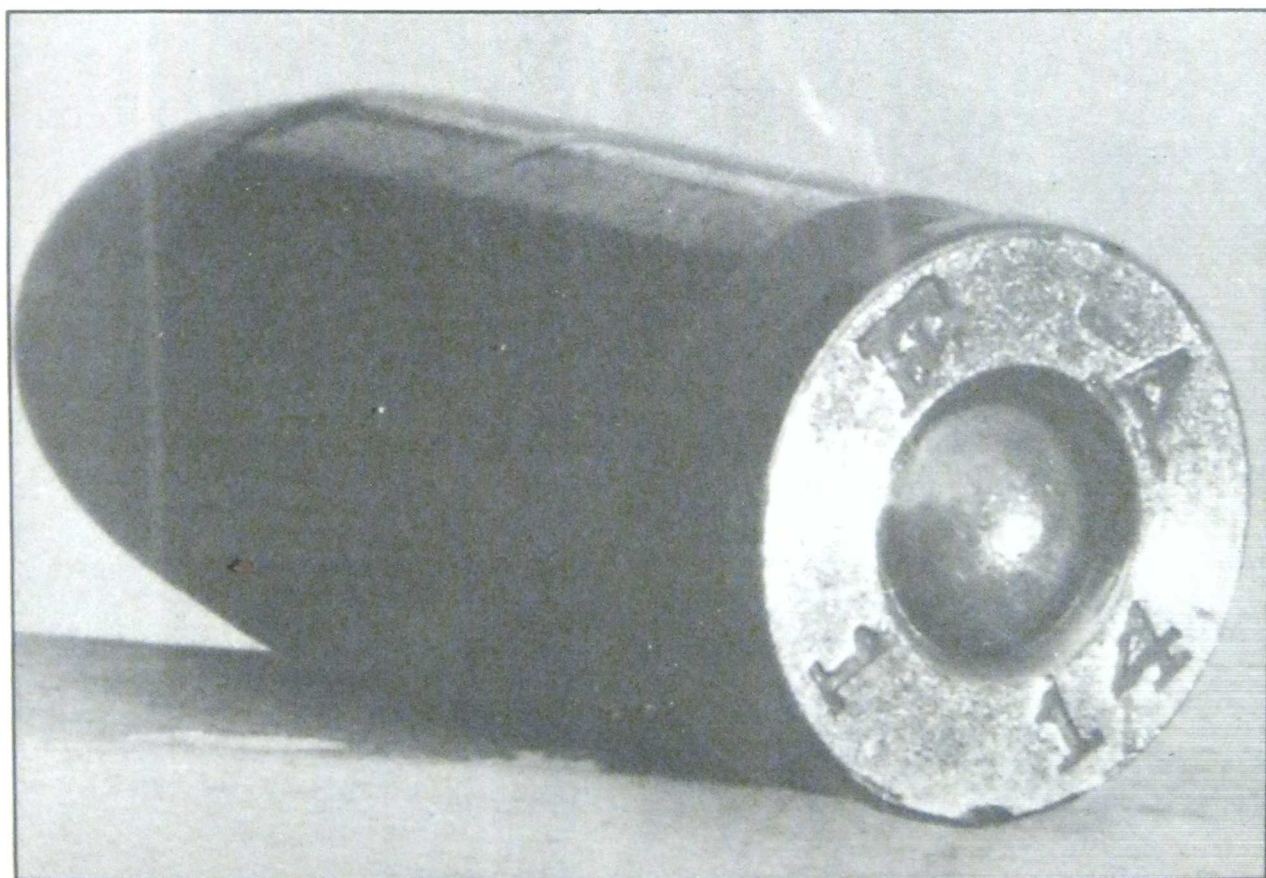


No longer available (sigh!), Bar-Sto used to make chambering gauges from reject barrels. This one has an .899 chamber. Lower photo offers a keener look at the rifling leade. Arrow indicates its transition to land.

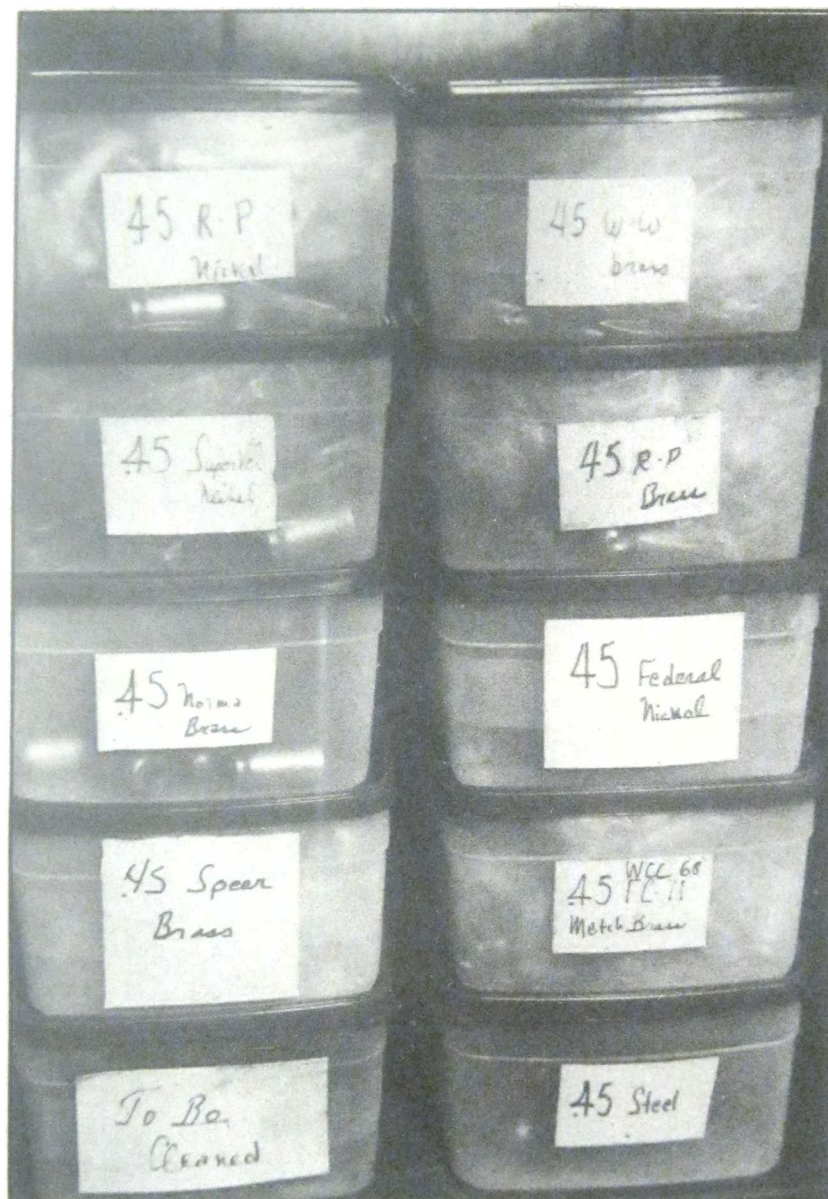




Above. So you pull the barrel from your M1911 and drop one of your reloads into the chamber and take a thoughtful squint at the disparate propinquity of the case head and the rear surface of the barrel shroud. They're supposed to come out neatly flush, as in the photo on a previous page. Usually, they'll end up somewhat as shown here and yes, it's downright discombooberating, ain't it? "The 45 ACP headspaces upon the chamber mouth." Umm, yasss... (Below) Hamilton discovered that a few of the old-time cases turned out by Frankford Arsenal actually measured the textbook .898-inch. Here's an FA case made in January 1914 in the days when they changed headstamp dies on the first of the month



The Key To Pistol Headspace Problems May Be Simply Longer Brass!



Hamilton measured every round of new and used .45 ACP brass he had on hand; no small chore!

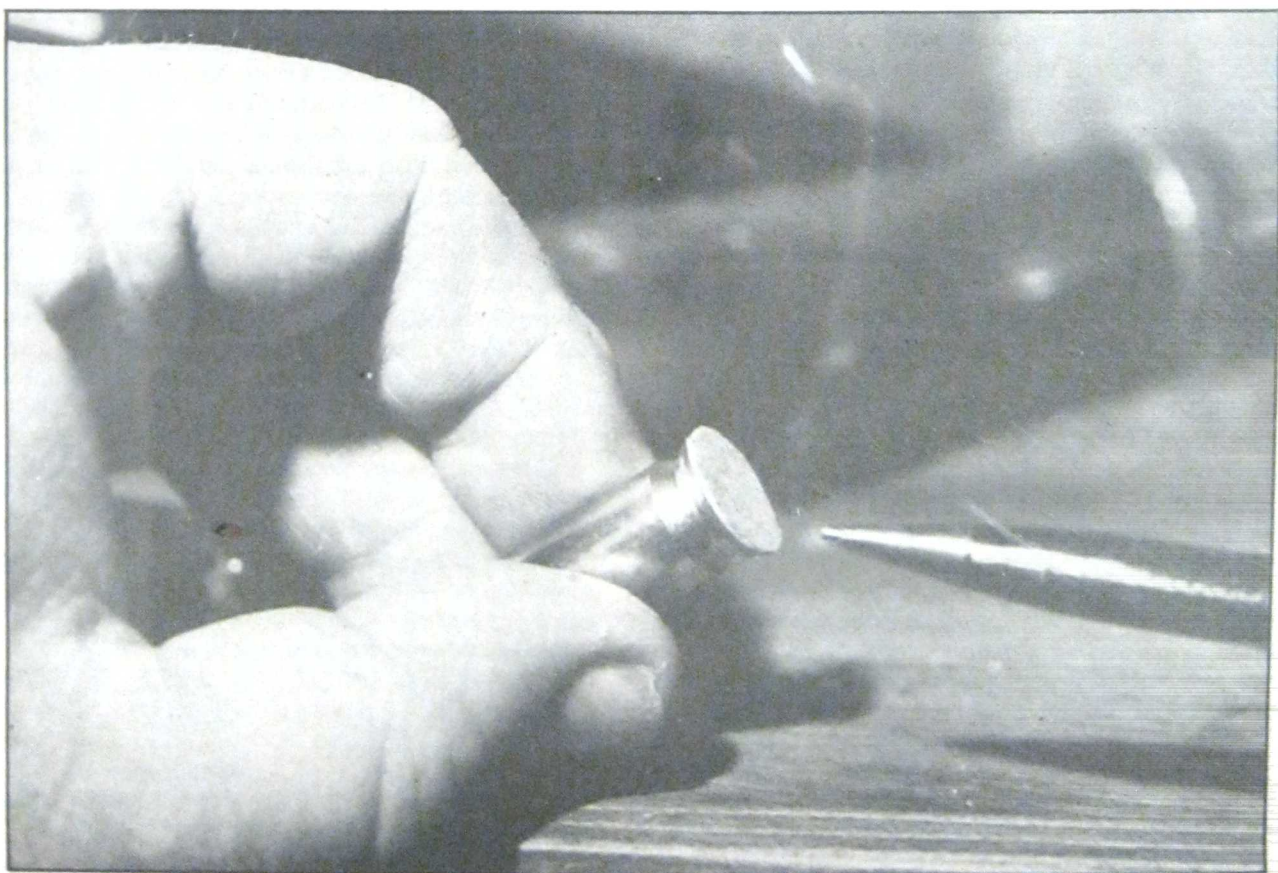
AFTER A SUMMER and Fall of shooting, I came away a little disappointed at the level of accuracy turned in by some fine handguns. In particular, I've been able to shoot only one decent group at twenty-five yards off the Ransom Rest with the .45 ACP Government Model; about an inch in size, shot with a stainless Hardballer, using Federal full metal jacket (FMJ) match semi-wadcutters.

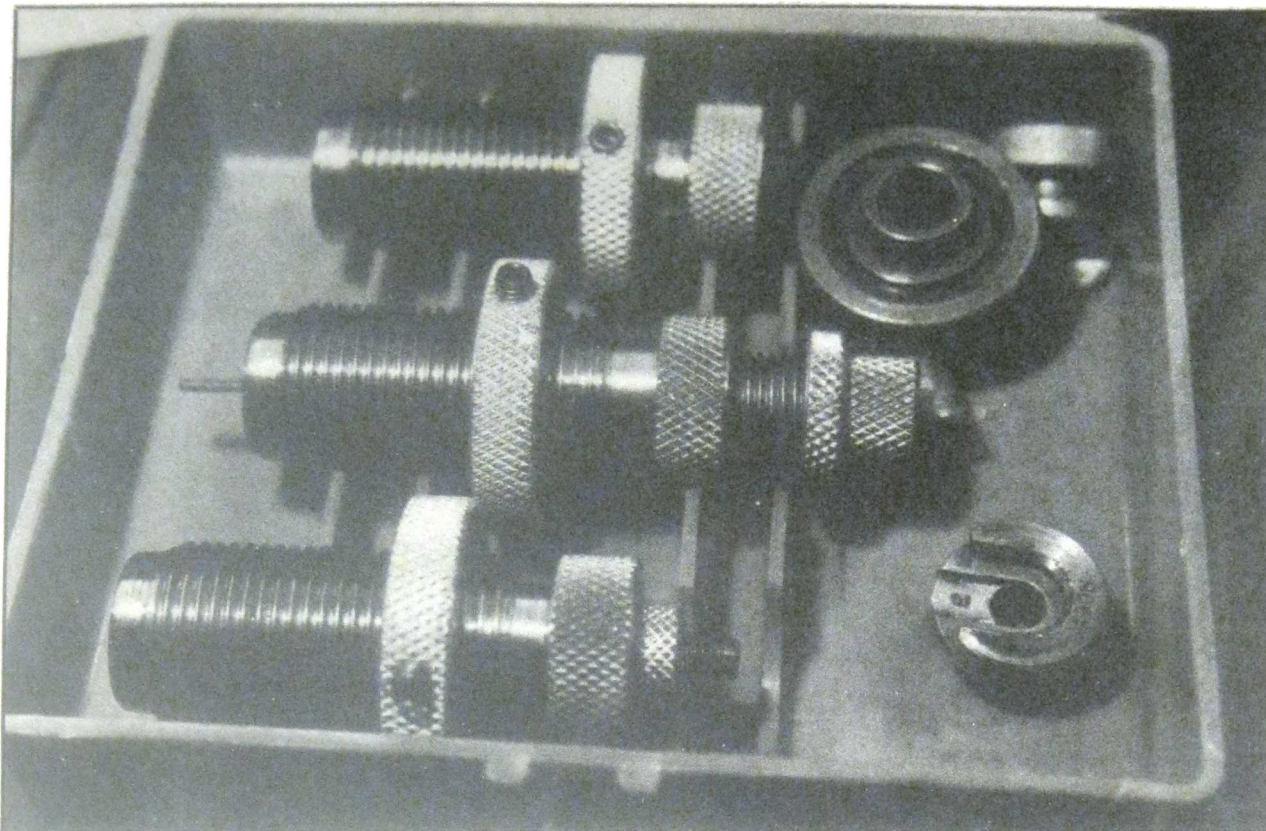
We have learned a great deal about the .45 Government

Model and its many variations since the general shooting public first began to take an interest in the old gun, so many years ago. Much has been written about loose military tolerances, found even in some commercial models, and how necessary it is to tighten up the barrel-to-slide fit front and rear. Slides then must be carefully tightened to mate well to the receiver and most triggers can use some smoothing. I have no argument with all this, but it's just not enough.



Above: Cartridges were loaded with identical loads, but in cases of four different lengths. It's hardly surprising that groups grew progressively larger as case lengths became shorter! Hamilton checked the sloppy lockup of M1911 pistols by pasting cardboard disks to the base of cartridges, which then proceeded to feed and chamber just as easily as did cartridges closer to the specified case lengths





In the example of cartridges for autoloading pistols such as the M1911, all of the passes into and out of reloading dies tend to shorten overall case length. The only elongating factor at work is the actual firing.

The cartridge is designed to headspace in most modern pistols on the case mouth as it comes to rest against the origin of the rifling. If the cartridge case is too short by even a small amount, what usually happens is that the extractor claw grabs the base of the cartridge and holds it securely against the breech face. This leaves the short case and its bullet unsupported at the front end and free to wander about in the chamber. Accuracy goes right out the window when this condition exists no matter how well tuned the gun may have been.

There are two root causes of headspace problems with the Government Model that I have encountered. The first and most obvious is that commercial cases these days are made too short. The standard length shown in the loading manuals is .898-inch for the .45 ACP case. I've just run a check on all my used and new brass on hand and I found only one batch of new Remington-Peters (R-P) cases that miked as much as .895-inch! All of my used brass, with one notable exception, measured well below .895-inch; the average length was about .891-inch.

To verify this official length of .898-inch I checked the length of the chambers of the .45s I have used. None was less than .896 and one measured .898. Just to see how much of a problem this condition of excessive headspace was making for me, I selected some new R-P cases that measured .895-inch, some new Winchester-Western (W-W) brass at .893, and two batches of used brass, Federal at .890 and R-P at .886. I loaded all of these cases identically

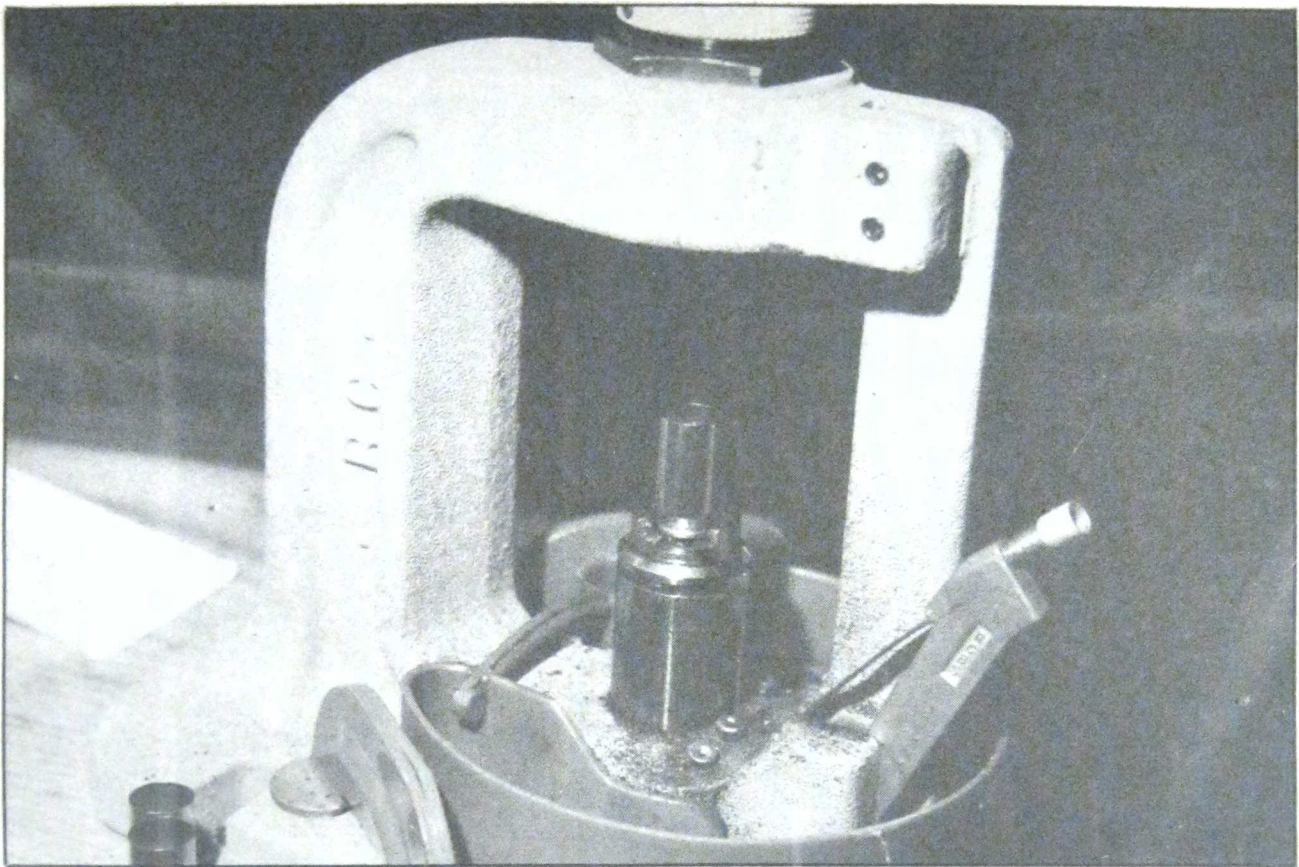
using W-W No. 7-111 large pistol primers and 5.2 grains of Red Dot behind the Speer 200-grain jacketed hollow point (JHP) bullet. I fired each of these batches for groups off the Ransom Rest. As I expected, the groups got progressively larger as the cases got shorter! The best I could get out of my reasonably tight old Colt was about 2½ inches and the worst was near four inches.

I became convinced as a result of my check of used cases that the reloading process causes progressive case shortening in the .45 ACP. Three of the operations we go through — full-length resizing, neck expanding and bullet seating — exert a strong pressure to decrease case length. The only thing that works the other way is firing itself and I doubt that shooting balances out the effect of bullet seating.

To confirm this impression I took three fresh rounds of the R-P nickel cases that measured .895-inch and loaded them as before using the same primer, bullet, and charge of Red Dot. Using my basement bullet trap, I fired these three cartridges through the old Colt. I recovered the three cases, reloaded them and measured the new case length loaded, repeating the process three times. Here are the average case lengths I had at the end of each reloading operation:

Start	.895-inch
1st reload	.892-inch
2nd reload	.891-inch
3rd reload	.889-inch

Unfortunately, with the old Government Model, case



A .45 ACP case on its way up in the press to be slightly shortened in overall length. In point of fact, it's awfully hard to find even a virgin factory round of .45 ACP with an .898-inch case: check and see!

length isn't the only problem. Old John Browning was no doubt a genius, but he had one flaw in many of his designs. He did not design good arrangements for holding his guns in battery. A beautiful example is the fine old Automatic 5 shotgun. The barrel and bolt are held in position with a bit more than an inch of wood in the forend. The Government Model Colt is similar. As it closes, two carefully fitted points on the upper part of the barrel near the locking lugs should come to rest on two points on the inner part of the slide. The barrel link can pivot upward no more and everything stops. Even in well fitted pistols, locking lugs don't always mesh properly in their recesses, or the barrel extension is a hair too long, or the barrel link or its pivot pin wears, or the friction as the under barrel lug rises in its recess begins before the top point is reached. Lint, foreign matter, excess grease, all contribute to a decidedly springy lockup which can vary several thousandths from shot to shot. For a graphic illustration of what I mean, select a .45 ACP cartridge that measures a full .895-inch case length. Cut a piece of thin cardboard in the form of a disk to match the size and shape of the case head. Paste it over the case head with a dab of rubber cement and cram the result into the chamber of your tightest gun. Let the slide go and my hunch is that it will close and lock up as usual! All the guns I have tried lock with the cardboard and most will take double and triple thicknesses.

One answer might be to wait for Winchester's new .45 magnum ammunition to become available, then trim back

those longer cases to about .900-inch. Those of us with a quantity of perfectly good used .45 ACP brass on hand might try seating the bullets out slightly to compensate for the shorter cases. With luck, these will contact the origin of the rifling and serve to center up the cartridge in the chamber. I've tried this approach and it works tolerably well in my older Colt.

I tried three lengths overall (LOA) for cartridges loaded with my short cases. All are short enough to work through the magazine without difficulty.

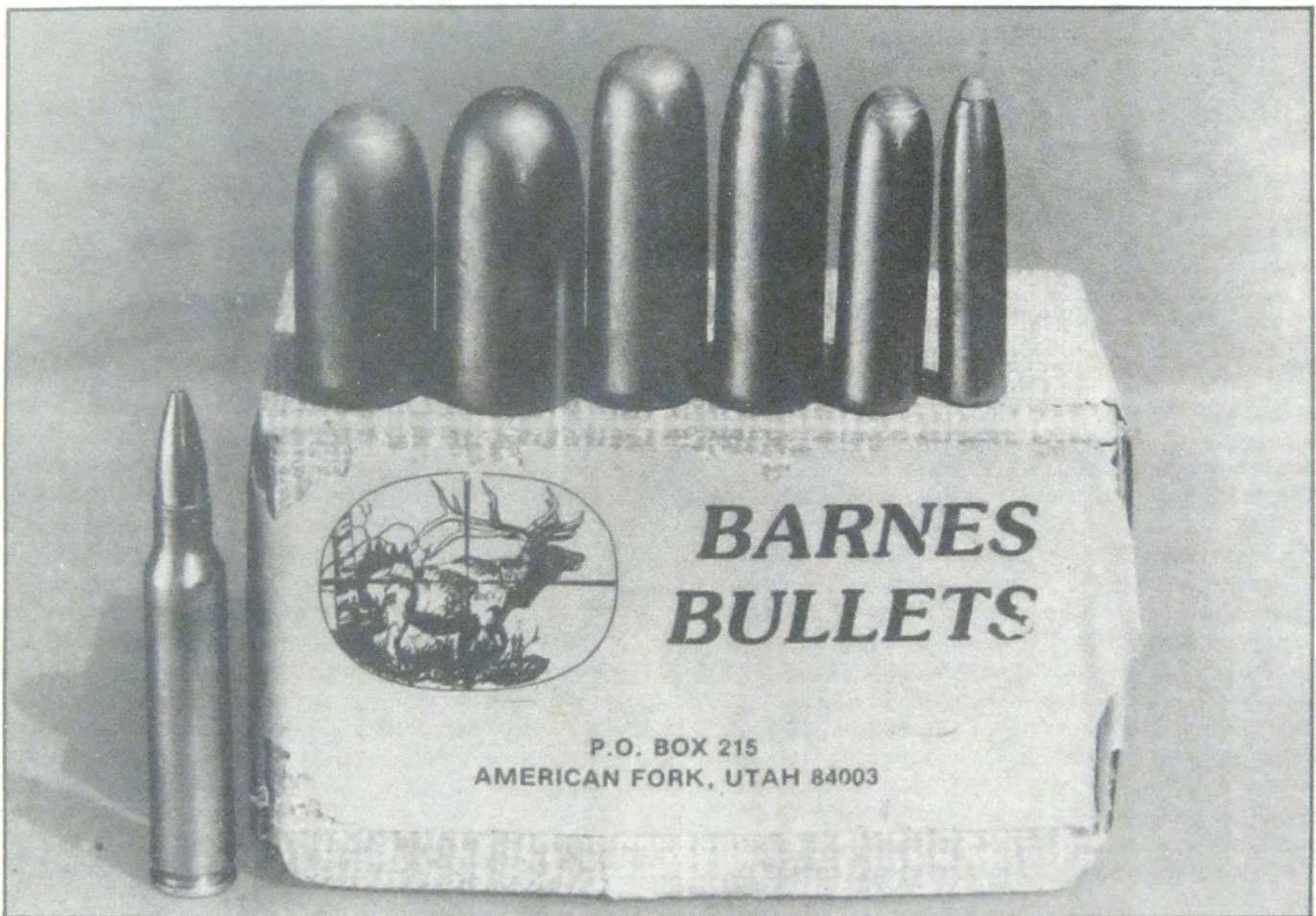
230 FMJ LOA (inches)	Average Group Size (inches)
1.262	3.1
1.267	2.2
1.275	2.1

I'm not sure what the optimum LOA might be, but I think that it is probably something to be worked out for each individual gun. It depends a great deal upon the shape of the bullet used.

I mentioned that there was one exception to the short cases I found. It was some old Frankford Arsenal brass dated 1913 through 1916 which have recently been found on our range. This old stuff measures a full .900-inch. It shows me that the old-timers were well aware of this headspace problem with the .45 ACP and compensated for it in their target ammunition.

SHOPPING FOR BULLETS

If You Don't Care To Roll Your Own, You Can Buy The
Tailor-mades And Here Are Several Of Those Available!

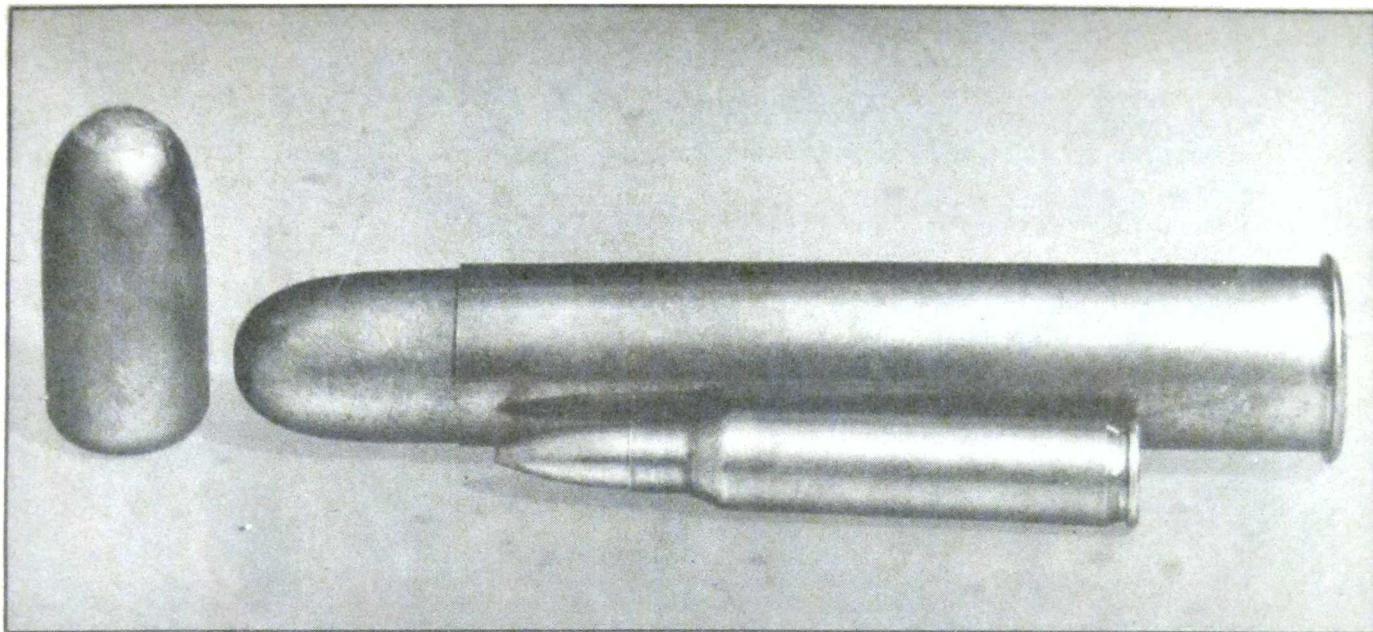


Specializing in the larger, less popular diameters as well as the heavier versions of popular calibers, Barnes Bullets offers many weights, sizes and types hardly available elsewhere. Their current address appears on the box label and that's a .223 Remington cartridge for size comparison to .600 and smaller Barnes Bullets.

YOU'VE RETAINED YOUR cartridge cases, being well aware of their intrinsic value. You've purchased powder and primers, mindful it's not practical to produce those at home. You have your press and its necessary tooling, along with powder scale and measure, one or more handbooks/manuals giving the proper amount of powder for any given

weight of bullet in the particular cartridge. What you still need is the bullet, itself.

You've your choice between two approaches: Buy'em or build'em. We'll be covering the latter in terms of its ramifications and complexities, which aren't overly challenging, as it turns out. In the meantime, itching to get on into the mysteries of reloading, you're willing to buy a box



Here's the .600 Nitro Express cartridge carrying the Barnes solid point bullet, with a matching soft point standing up at left. Again, one of the familiar .223 Remington rounds is included for comparison of size.

or three of bullets and hang the cost. We're here to talk about that.

Bullets for reloading most of the reasonably common and popular cartridges are more or less available upon the open market. Within fairly recent times, the offering for the .32 S&W Long has been painfully sparse, but even that one is improving. Alberts and Hornady have added excellent performers for it. Sierra and Hornady catalog really nice bullets for the .41 magnum, although Speer hews to their fierce conviction that the .41 is a flash in the pan which will never amount to anything. Speer lists two half-jacketed numbers for the .41, with solid and hollow points.

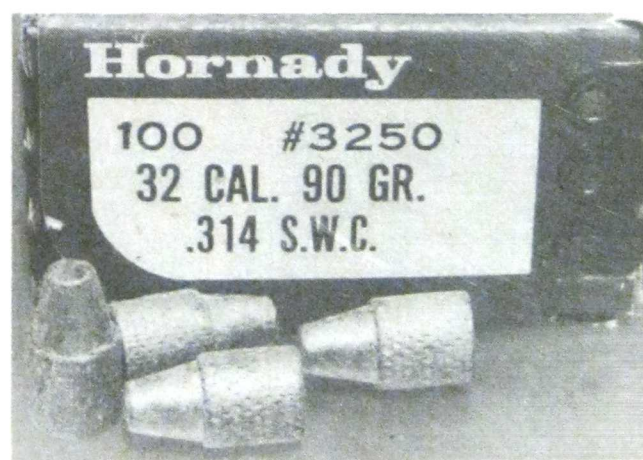
At one time, both Winchester and Remington marketed the bullets they use in making up factory loads, but they cut that out some years back; a great pity.

In 1968, Sirhan K. Sirhan shot Bobby Kennedy with a revolver firing .22 rimfire ammo and the lawmakers

responded by passing the Gun Control Act of 1968 (GCA 68) which, among many other strictures, forbade the shipping of bullets for reloading across state lines. The icy logic of that step continues to elude me. To the best of my knowledge, no President or other leading citizen of this country has ever been assassinated with a reloaded cartridge.

But 1968 was a time of vast hand-wringing and ill-directed do-gooding and we're still putting up with its aftermath, a goodly while later. In those days, I knew of several people who earned modest pittances by producing bullets for reloading and huckstering them through the mails. That all came to an end in '68 and no one will ever convince me it wasn't a dirty shame.

Within recent times, the pro-gun factions have succeeded in getting the GCA '68 modified so it's no longer necessary for firearms dealers to keep strict track of all the



Left: The Sierra #1400 bullet has come to be one of my favorites for the .223 Remington and several other cartridges that take that diameter. (Right) Hornady's #3250 bullet for the .32 S&WL or .32 H&R magnum is swaged out of lead and the base portion is knurled to carry the lubricant in a uniform and effective manner.



Hornady #3031 has what its maker terms a secant ogive along its spire point. It has long been one of my favorites in rounds such as .300 Win. mag or .30/06.



Made with a flat tip for use in tubular magazines, the Speer #2007 displays awesome expansion when loaded to typical .30/06 velocities.



One of the best and most accurate bullets for the 9mm Luger, the Hornady #3554 usually feeds well and it also delivers highly respectable expansion.

rimfire ammo they sell. It was rimfire ammo that laid Bobby Kennedy low. The restrictions against transmitting a cast .38 bullet across state lines remain in force and there's no realistic hope they'll be rescinded soon. So it goes.

In spite of all that, a small-scale bulletmaker can still hawk his/her wares via intrastate commerce, and quite a few of them do just that. It's still a case of locking the barn doors to protect a horse that no one in their right mind would be inclined to steal, but that's the way the mop she flop, no?

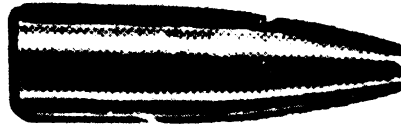
With Remington-Peters and Winchester-Western voluntarily withdrawn from the race, we are left with the Big Four bulletmakers: Hornady, Nosler, Sierra and Speer, ranked alphabetically, plus a few others. For example,

Barnes specializes in unlikely diameters such as .228-inc and bullets of popular diameters in unpopular weights.

In ABC/R-1, we ran charts of the bullets available for purchase and, encountering difficulties in including it in ABC/R-2, deleted it. Feedback from the reader/buyer left little doubt they'd missed that feature, and keenly. In ABC/R-3, we propose to include all the charts we can manage to cozen out of the various makers. If any are missing, it is solely because the manufacturers failed or refuse to respond to courteous requests.

The charts we were able to obtain follow. Prices have been deleted for the sake of realism because books such as this tend to remain in circulation through an extended number of price changes.

By way of making the pages come out even, I will toss in

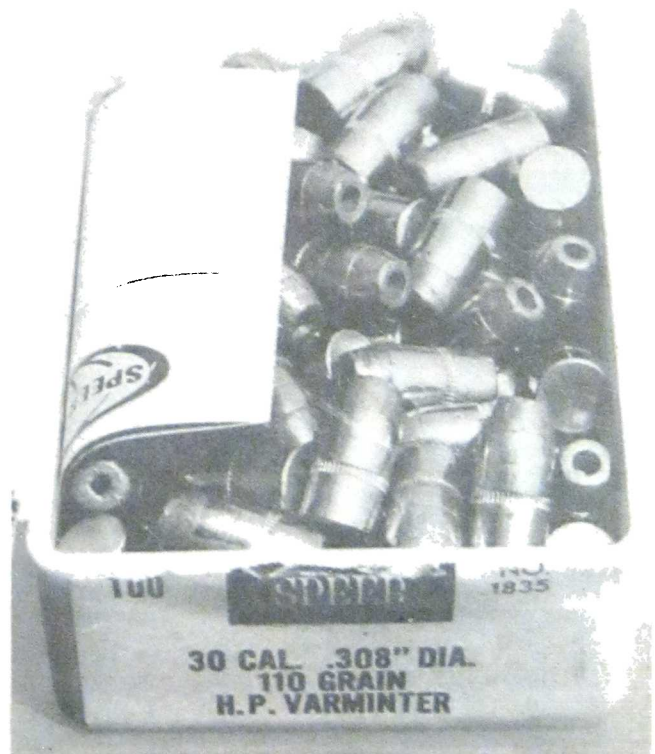
100**SPEER****#2005****30 CAL.****130****GR.****.308" HOLLOW POINT**

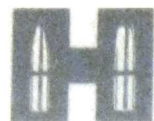
As may be discussed in various places here, the Speer #2005 is a bullet that has given me exceptionally fine groups in targets on many occasions with many different caliber .30 guns. I'd be surprised if it didn't prove capable of good expansion on game but, to the best of my recollection, have never used it for hunting purposes.



On the other hand, Speer's #2011 is one I've used on many occasions for hunting, always with excellent results, particularly in .30/06 approaching 3000 fps. (Right) The #1835 Speer Varminter is a great little blaster, particularly if your rifle groups it well.

a few illustrations of some of the factory bullets I've had reason to hold in awed good regard over the past several years. There are a great many excellent factory bullets, but those illustrated have demonstrated an uncommon amount of magical charm and I regard it as a service to reader and maker alike to pass the word along.





Hornady Bullets... A complete selection for every shooting purpose.

RIFLE BULLETS

"I" denotes interlock bullets

■ 17 CALIBER (.172)

25 gr. HP #2210

■ 22 CALIBER (.222)

40 gr. Jet #2210

■ 22 CALIBER (.223)

45 gr. Hornet #2220

■ 22 CALIBER (.224)

45 gr. Hornet #2230

50 gr. SPSX #2240

50 gr. SP #2245

■ 22 CALIBER MATCH

52 gr. BTHP #2249

■ 22 CALIBER MATCH

53 gr. HP #2250

55 gr. SPSX #2260

55 gr. SP #2265

55 gr. SP w/c #2266

55 gr. FMJ-BT w/c #2267

60 gr. SP #2270

60 gr. HP #2275

■ 22 CALIBER (.227)

70 gr. SP #2280

■ 6MM CALIBER (.243)

70 gr. SP #2410

75 gr. HP #2420

6MM CALIBER (.243) continued

80 gr. FMJ #2430

87 gr. SP #2440

87 gr. BTHP #2442

I 100 gr. SP #2450

I 100 gr. BTSP #2453

I 100 gr. RN #2455

■ 25 CALIBER (.257)

60 gr. FP #2510

75 gr. HP #2520

87 gr. SP #2530

I 100 gr. SP #2540

I 117 gr. RN #2550

I 120 gr. HP #2560

■ 6.5MM CALIBER (.264)

100 gr. SP #2610

I 129 gr. SP #2620

I 140 gr. SP #2630

I 180 gr. RN #2640

■ 270 CALIBER (.277)

100 gr. SP #2710

270 CALIBER (.277) continued

110 gr. HP #2720

I 130 gr. SP #2730

I 140 gr. BTSP #2735

I 150 gr. SP #2740

I 150 gr. RN #2745

■ 7MM CALIBER (.284)

100 gr. HP #2800

120 gr. SP #2810

120 gr. HP #2815

I 139 gr. BTSP #2820
#2820A +

I 139 gr. BTSP #2825
#2825A +

I 154 gr. SP #2830
#2830A +

I 154 gr. RN #2835

■ 7MM MATCH

162 gr. BTHP #2840
#2840A +

I 182 gr. BTSP #2845
#2845A +

I 175 gr. SP #2850

I 175 gr. RN #2855

■ 30 CALIBER (.308)

100 gr. SJ #3005

Prices effective January 1, 1984
(All prices subject to change without notice)

30 Caliber (.308) continued

110 gr SP #3010



110 gr RN #3015



110 gr FMJ #3017



130 gr SP #3020

150 gr SP #3031



150 gr RN (30-30) #3035



150 gr FMJ-BT #3037



165 gr SP #3040



165 gr BTSP #3045

30 CALIBER NEW NATIONAL MATCH



168 gr BTHP #3050
#3050A +



170 gr FP (30-30) #3060



180 gr SP #3070



180 gr RN #3075

30 CALIBER MATCH



190 gr BTHP #3080
#3080A +



190 gr BTSP #3085
#3085A +



220 gr RN #3080

303 CAL. and 7.7 JAP (.312)



150 gr SP #3120



174 gr RN #3130

32 SPECIAL (.321)



170 gr FP #3210

8MM CALIBER (.323)



125 gr SP #3230



150 gr SP #3232



170 gr RN #3235

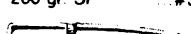


220 gr SP #3238

338 CALIBER (.338)



200 gr SP #3310



200 gr FP (33 Win.) #3315



225 gr SP #3320



250 gr RN #3330

348 CALIBER (.348)



200 gr FP #3410

35 CALIBER (.358)



200 gr SP #3510
#3510A +



200 gr RN #3515



250 gr RN #3525

375 CALIBER (.375)



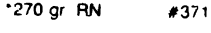
220 gr FP (375 Win.) #3705



270 gr SP #3710



270 gr RN #3715

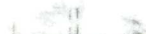


300 gr RN #3720



300 gr FMJ RN #3727

44 CALIBER (.430)



265 gr FP #4300

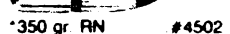
45 CALIBER (.458)



300 gr HP #4500



350 gr RN #4502



500 gr RN #4504



500 gr FMJ-RN #4507

* Packed 50 per box
+ Bulk Packaged in Box of 500

LEGEND

BBWC—Bevel Base Wadcutter	RN—Round Nose
BT—Boat Tail	SJ—Short Jacket
DEWC—Double End Wadcutter	SP—Spire Point
FMJ—Full Metal Jacket	SWC—Semi-Wadcutter
FP—Flat Point	SX—Super Explosive
HBWC—Hollow Base Wadcutter	JTC—Jacketed Truncated Cone
HP—Hollow Point	SIL—Silhouette

PISTOL BULLETS

38 Caliber (.357) continued

25 CALIBER (.251)



50 gr. FMJ RN #3545

32 Caliber (.308)



71 gr. FMJ-RN #3200

9MM CALIBER (.355)



90 gr. HP #3550



100 gr. FMJ #3552



115 gr. HP #3554



124 gr. FMJ-FP #3556



124 gr. FMJ RN #3557

38 CALIBER (.357)



110 gr. HP #3570



125 gr. HP #3571



125 gr. FP #3573



140 gr. JHP #3574



158 gr. HP #3575



158 gr. FP #3578



160 gr. JTC-SIL #3572
#3572A +



180 gr. JTC-SIL #3577
#3577A +

41 CALIBER (.410)



210 gr. HP #4100



210 gr. FMJ/FP #4103

44 CALIBER (.430)

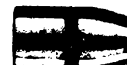


200 gr. HP #4410

44 CALIBER (.430)



240 gr. HP #4420



240 gr. JTC-SIL #4425
#4425A +

45 CALIBER (.451)



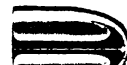
185 gr. HP, ACP #4510



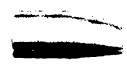
185 gr. Target
SWC, ACP #4513



200 gr.
FMJ-C/T (Match) #4515



230 gr. FMJ-RN #4517



230 gr. FMJ-FP #4518

45 CALIBER (.452)



250 gr. Long
Colt HP #4520

LEAD PISTOL BULLETS

32 cal. (.314)



90 gr. SWC #3250
#1000

38 cal. (.358)



148 gr. BBWC #3580
#1010

38 cal. (.358)



148 gr. HBWC #3582
#1020

38 cal. (.358)



148 gr. DEWC (Bulk only)
#1030

38 cal. (.358)



158 gr. RN #3586
#1050

38 cal. (.358)



158 gr. SWC #3588
#1040

44 cal. (.430)



240 gr. SWC #4430
#1110

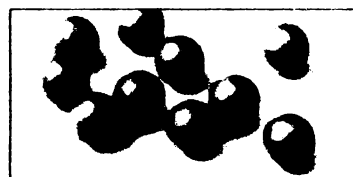
45 cal. (.452)



200 gr. SWC #4526
#1210

Bulk lead bullets must be ordered in increments of carton quantities per bullet. 5000 bullets per carton except 44 caliber is 4000 per carton

500 Per Box except 44 cal. (400 Per Box)
Bulk Price Per 1000



ROUND LEAD BALLS

Here is an item for Black Powder shooters. Round Lead Balls in 15 sizes, from .310 through .570

310	#6000
315	NEW #6003
350	#6010
375	#6020
433	#6030
440	#6040
445	#6050
451	#6060
454	#6070
457	#6080
490	#6090
495	NEW #6093
530	#6100
535	#6110
570	#6120

* Packed 50 Per Box
All Others Packed 100 Per Box

Nosler Solid Base™ Boat Tail Bullets



Caliber	Diameter	Bullet Weight and Style
22	224"	45 Gr. Hornet
	224"	50 Gr. Expander
	224"	50 Gr. Spitzer
	224"	50 Gr. Hollow Point
	224"	52 Gr. Spitzer
	224"	52 Gr. Hollow Point
	224"	52 Gr. Hollow Point Match
	224"	55 Gr. Spitzer
6 mm	224"	60 Gr. Spitzer
	243"	70 Gr. Hollow Point
	243"	70 Gr. Hollow Point Match
	243"	75 Gr. Spitzer
	243"	85 Gr. Spitzer
25	243"	100 Gr. Spitzer
	243"	120 Gr. Spitzer
6.5 mm	264"	120 Gr. Spitzer
270	277"	100 Gr. Spitzer
	277"	130 Gr. Spitzer
	277"	150 Gr. Spitzer
7 mm	284"	120 Gr. Spitzer
	284"	140 Gr. Spitzer
	284"	150 Gr. Spitzer
	284"	162 Gr. Spitzer
30	308"	150 Gr. Flat Point
	308"	150 Gr. Spitzer
	308"	150 Gr. Hollow Point
	308"	150 Gr. Hollow Point Match
	308"	165 Gr. Spitzer
	308"	168 Gr. Hollow Point
	308"	168 Gr. Hollow Point Match
	308"	170 Gr. Flat Point
	308"	180 Gr. Spitzer
	308"	

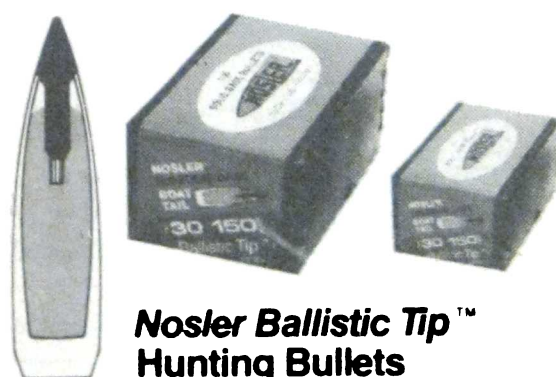
Nosler Ballistic Tip™ Bullets

Caliber	Diameter	Bullet Weight and Style
270	277"	130 Gr. Ballistic Tip (Yellow)
	277"	150 Gr. Ballistic Tip (Yellow)
7 mm	284"	140 Gr. Ballistic Tip (Red)
	284"	150 Gr. Ballistic Tip (Red)
30	308"	150 Gr. Ballistic Tip (Green)
	308"	165 Gr. Ballistic Tip (Green)
	308"	180 Gr. Ballistic Tip (Green)



Nosler Solid Base™ Boat Tail Bullets

Competitively priced, Nosler Solid Base bullets offer both tighter groups and better game stopping power. The boat tail design improves the ballistic coefficient for better performance at long range.



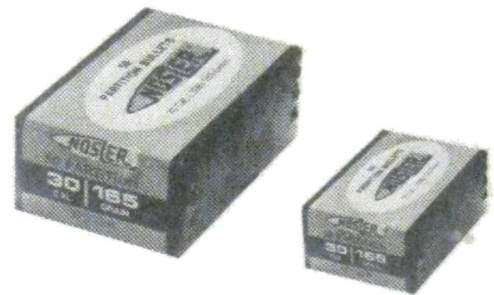
Nosler Ballistic Tip™ Hunting Bullets

In this new series of Solid Base hunting bullets, Nosler has replaced the familiar lead point of the Spitzer with a tough polycarbonate tip. The purpose of this new Ballistic Tip is to resist deforming in the magazine and feed ramp of many rifles. The Solid Base design produces controlled expansion for excellent mushrooming and penetration.



Nosler Partition™ Bullets

Caliber	Diameter		Bullet Weight and Style
6 mm	.243"		95 Gr. Spitzer
	.243"		100 Gr. Spitzer
25	.257"		100 Gr. Spitzer
	.257"		120 Gr. Spitzer
6.5 mm	.264"		125 Gr. Spitzer
	.264"		140 Gr. Spitzer
270	.277"		130 Gr. Spitzer
	.277"		150 Gr. Spitzer
	.277"		160 Gr. Semi Spitzer
7 mm	.284"		140 Gr. Spitzer
	.284"		150 Gr. Spitzer
	.284"		160 Gr. Spitzer
	.284"		175 Gr. Semi Spitzer
30	.308"		150 Gr. Spitzer
	.308"		165 Gr. Spitzer
	.308"		180 Gr. Spitzer
	.308"		180 Gr. Protected Point
	.308"		200 Gr. Spitzer
8 mm	.323"		200 Gr. Spitzer
.338	.338"		210 Gr. Spitzer
	.338"		250 Gr. Spitzer



Nosler Partition™ Bullets

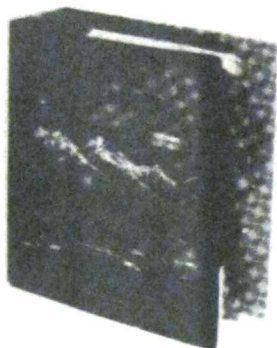
The Nosler Partition bullet earned its reputation among professional guides and serious hunters for one reason: it doesn't fail. The patented Partition design offers a dual core that is unequalled in mushrooming weight retention and hydrostatic shock.



Nosler Reloading Manual Number Two

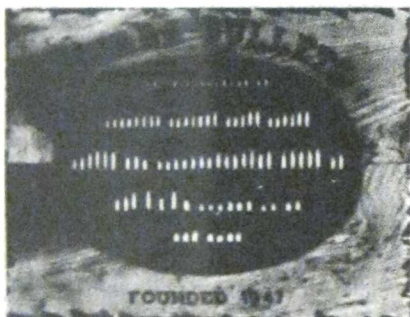
Nosler Reloading Manual Number Two. Over 300 fact-filled pages. Loading data for all popular calibers. Interesting as well as informative. Beginner through expert, no reloader should be without it. Even tips for competitive shooters.

For over 30 years shooters have associated accuracy and superior ballistic performance with one name more than any other - Sierra. On the range or in the field Sierra bullets offer that extra margin of performance that shooters can depend on. Today Sierra offers 113 different rifle and pistol bullets to satisfy nearly any need. No wonder more shooters are moving to Sierra.



The Sierra Reloader's Manual

Seven hundred pages of practical and theoretical information for handloaders. The Sierra Reloader's Manual is the most comprehensive in the shooting industry. It is designed for the novice and the advanced reloader alike.



The Sierra Bullet Board
Hand made California Redwood frame. A complete selection of genuine Sierra Bullets. Classic copper metallic printing. One of a limited collection.

.22 Caliber (.223 Diameter) Hornet



1100 40 gr. Hornet

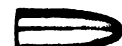


1110 45 gr. Hornet

.22 Caliber (.224 Diameter) Hornet



1200 40 gr. Hornet



1210 45 gr. Hornet

.22 Caliber 5.56 MM (.224 Diameter) High Velocity



1300 45 gr. SMP



1310 45 gr. SPT



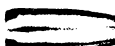
1320 50 gr. SMP



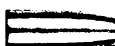
1330 50 gr. SPT



1340 50 gr. Blitz



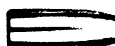
1410 52 gr. HPBT



1400 53 gr. HP



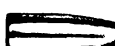
1345 55 gr. Blitz



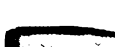
1350 55 gr. SMP



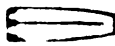
1355 55 gr. FMJBT



1360 55 gr. SPT



1390 55 gr. HPBT **NEW**



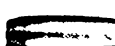
1365 55 gr. SBT



1375 60 gr. HP **NEW**



1370 63 gr. SMP

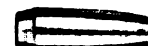


1380 69 gr. HPBT **NEW**

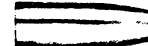
6 MM .243 Caliber (.243 Diameter)



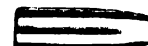
1500 60 gr. HP



1505 70 gr. HPBT



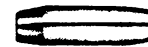
1510 75 gr. HP



1520 85 gr. SPT



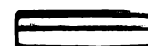
1530 85 gr. HPBT



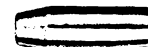
1535 90 gr. FMJBT **NEW**



1540 100 gr. SPT

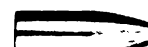


1550 100 gr. SMP

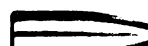


1560 100 gr. SBT

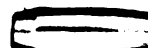
.25 Caliber (.257 Diameter)



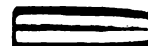
1600 75 gr. HP



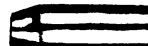
1610 87 gr. SPT



1615 90 gr. HPBT



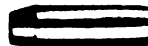
1620 100 gr. SPT



1630 117 gr. SBT



1640 117 gr. SPT



1650 120 gr. HPBT

6.5 MM .264 Caliber (.264 Diameter)



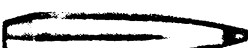
1700 85 gr. HP



1710 100 gr. HP



1720 120 gr. SPT



1730 140 gr. SBT

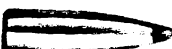


1740 140 gr. HPBT

.270 Caliber (.277 Diameter)



1800 90 gr. HP



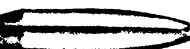
1810 110 gr. SPT



1820 130 gr. SBT



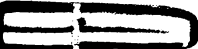
1830 130 gr. SPT



1835 140 gr. HPBT **NEW**



1840 150 gr. SBT



1850 150 gr. RN

7 MM .284 Caliber (.284 Diameter)



1900 120 gr. SPT



1905 140 gr. SBT



1910 140 gr. SPT



1915 150 gr. HPBT



1920 160 gr. SBT



1930 168 gr. HPBT

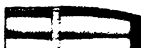


1950 170 gr. RN



1940 175 gr. SBT

.30 (30-30) Caliber (.308 Diameter)



2020 125 gr. HP



2000 150 gr. FN

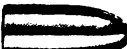


2010 170 gr. FN

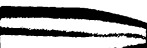
.30 Caliber 7.62 MM (.308 Diameter)



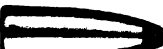
2100 110 gr. RN



2105 110 gr. FMJ



2110 110 gr. HP



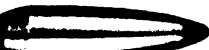
2120 125 gr. SPT



2115 150 gr. FMJBT **NEW**



2130 150 gr. SPT



2125 150 gr. SBT



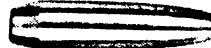
2190 150 gr. HPBT



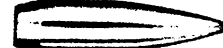
2135 150 gr. RN



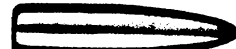
2145 165 gr. SBT



2140 165 gr. HPBT



2200 168 gr. HPBT



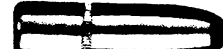
2150 180 gr. SPT



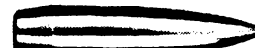
2160 180 gr. SBT



2220 180 gr. HPBT



2170 180 gr. RN



2210 190 gr. HPBT



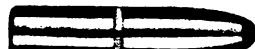
2165 200 gr. SBT



2230 200 gr. HPBT



2240 220 gr. HPBT



2180 220 gr. RN

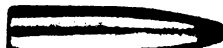
.303 Caliber (.311 Diameter)



2320 125 gr. FMJ **NEW**



2300 150 gr. SPT



2310 180 gr. SPT

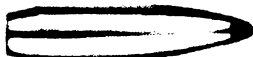
8 MM .323 Caliber (.323 Diameter)



2400 150 gr. SPT

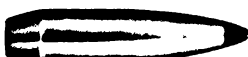


2410 175 gr. SPT



2420 220 gr. SBT

.338 Caliber (.338 Diameter)



2600 250 gr. SBT

.35 Caliber (.358 Diameter)



2800 200 gr. RN

.375 Caliber (.375 Diameter)



3000 300 gr. SBT

.45 Caliber (45-70) (.458 Diameter)



8900 300 gr. HP

.32 Caliber 7.65 MM (.311 Diameter)



8010 71 gr. FMJ **NEW**

9 MM .355 Caliber (.355 Diameter)



8100 90 gr. JHP



8105 95 gr. FMJ **NEW**



8110 115 gr. JHP



8115 115 gr. FMJ **NEW**



8120 125 gr. FMJ



8345 130 gr. FMJ **NEW**

.38 Caliber (.357 Diameter)



8300 110 gr. JHC Blitz **NEW**



8310 125 gr. JSP



8320 125 gr. JHC



8325 140 gr. JHC



8360 158 gr. JHC **NEW**



8340 158 gr. JSP



8365 170 gr. JHC **NEW**



8350 170 gr. FMJ Match

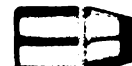


8370 180 gr. FPJ **NEW**

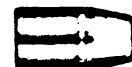
.41 Caliber (.410 Diameter)



8500 170 gr. JHC



8520 210 gr. JHC



8530 220 gr. FPJ Match

.44 Magnum (.4295 Diameter)



8600 180 gr. JHC



8620 210 gr. JHC



8605 220 gr. FPJ Match



8610 240 gr. JHC



8615 250 gr. FPJ **NEW**

.45 Caliber (.4515 Diameter)



8800 185 gr. JHP



8810 185 gr. FMJ Match



8825 200 gr. FPJ **NEW**



8815 230 gr. FMJ Match



8820 240 gr. JHP

Abbreviations:

SBT	— Spitzer Boat Tail
SPT	— Spitzer
HP	— Hollow Point
JHP	— Jacketed Hollow Point
JHC	— Jacketed Hollow Cavity
JSP	— Jacketed Soft Point
JWADC	— Jacketed Wadcutter
FN	— Flat Nose
RN	— Round Nose
FMJ	— Full Metal Jacket
HPBT	— Hollow Point Boat Tail
SMP	— Semi-Pointed
FPJ	— Full Profile Jacket

22 CALIBER (.223)



1005 40 Gr.
Spire Point



1011 45 Gr.
Spitzer

22 CALIBER (.224)



1017 40 Gr.
Spire



1023 45 Gr.
Spitzer



1029 50 Gr.
Spitzer



1035 52 Gr.
Hollow Point



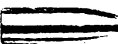
1045 55 Gr.
F.M.J.



1047 55 Gr.
Spitzer



1049 55 Gr.
Spitzer



1053 70 Gr.
Semi-Spitzer

6mm CALIBER (.243)



1205 75 Gr.
Hollow Point



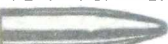
1211 80 Gr.
Spitzer



1213 85 Gr.
Boat Tail



1215 90 Gr.
F.M.J.



1217 90 Gr.
Spitzer



1220 100 Gr.
Boat Tail

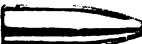


1223 105 Gr.
Round Nose

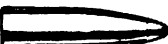


1229 105 Gr.
Spitzer

25 CALIBER (.257)



1241 87 Gr.
Spitzer



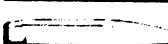
1405 100 Gr.
spitzer



1407 100 Gr.
Hollow Point



1408 100 Gr.
Boat Tail



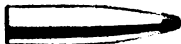
1410 120 Gr.
Boat Tail

BULLETS



1411 120 Gr.
Spitzer

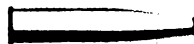
6.5mm CALIBER (.263)



1435 120 Gr.
Spitzer



1440 140 Gr.
Boat Tail



1441 140 Gr.
Spitzer

270 CALIBER (.277)



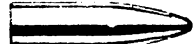
1447 100 Gr.
Hollow Point



1453 100 Gr.
Spitzer



1458 130 Gr.
Boat Tail



1459 130 Gr.
Spitzer



1465 130 Gr.
Grand Slam



1604 150 Gr.
Boat Tail



1605 150 Gr.
Spitzer



1608 150 Gr.
Grand Slam

7mm CALIBER (.284)



1617 115 Gr.
Hollow Point



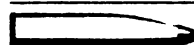
1623 130 Gr.
Spitzer



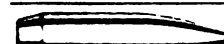
1624 130 Gr.
Boat Tail



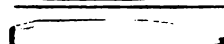
1628 145 Gr.
Boat Tail



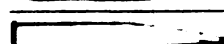
1629 145 Gr.
Spitzer



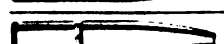
1631 145 Gr.
Match Boat Tail



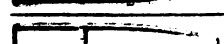
1634 160 Gr.
Boat Tail



1635 160 Gr.
Spitzer



1637 160 Gr.
Mag-Tip



1638 160 Gr.
Grand Slam



1641 175 Gr.
Mag - Tip



1843 175 Gr.
Grand Slam

30 CALIBER (.308)



1805 100 Gr.
Pinker



1835 110 Gr.
Hollow Point



1845 110 Gr.
Round Nose



1855 110 Gr.
Spire Point



2005 130 Gr.
Hollow Point



2007 130 Gr.
Flat Point



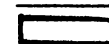
2011 150 Gr.
Flat Point



2017 150 Gr.
Round Nose



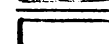
2022 150 Gr.
Boat Tail



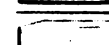
2023 150 Gr.
Spitzer



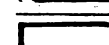
2025 150 Gr.
Mag - Tip



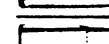
2029 165 Gr.
Round Nose



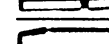
2034 165 Gr.
Boat Tail



2035 165 Gr.
Spitzer



2038 165 Gr.
Grand Slam



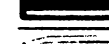
2040 168 Gr.
Match Boat Tail



2041 170 Gr.
Flat Point



2047 180 Gr.
Round Nose



2052 180 Gr.
Boat Tail



2053 180 Gr.
Spitzer



2059 180 Gr.
Mag - Tip



2063 180 Gr.
Grand Slam



2080 190 Gr.
Match Boat Tail

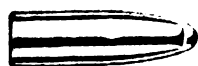


2211 200 Gr.
Spitzer

303 CALIBER (.311)



2217
150 Grain
Spitzer



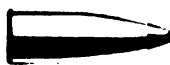
2223
180 Grain
Round Nose

32 CALIBER (.321)



2259
170 Grain
Flat Nose

8mm CALIBER (.323)



2277
150 Grain
Spitzer



2283
170
Semi-Spitzer

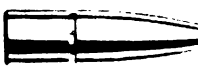


2285
200 Grain
Spitzer

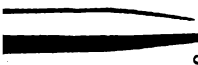
338 CALIBER (.338)



2405
200 Grain
Spitzer



2408
250 Grain
Grand Slam



2411
275 Grain
Semi-Spitzer

35 CALIBER (.358)



2435
180 Grain
Flat Nose



2439
220 Grain
Flat Nose



2453
250 Grain
Spitzer

375 CALIBER (.375)



2471
235 Grain
Semi-Spitzer



2473
285 Grain
Grand Slam

45 CALIBER (.458)



2479
400 Grain
Flat Nose

25 CALIBER (.251)



3982
50 Grain
FMJ

9mm CALIBER (.355)



4000
88 Grain
Hollow Point



3983
100 Grain
Hollow Point



3995
115 Grain
FMJ



3996
115 Grain
Hollow Point



4004
124 Grain
FMJ



4005
125 Grain
Soft Point

38 CALIBER (.357)



4007
110 Grain
Hollow Point



4011
125 Grain
Soft Point



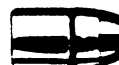
4013
125 Grain
Hollow Point



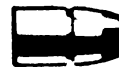
4203
140 Grain
Hollow Point



4205
146 Grain
Hollow Point



4211
158 Grain
Hollow Point



4217
158 Grain
Soft Point



4223
160 Grain
Soft Point



4229
180 Grain
FMJ

41 CALIBER (.410)



4405
200 Grain
Hollow Point



4417
220 Grain
Soft Point

44 CALIBER (.429)



4425
200 Grain
Mag Hollow Point



4435
225 Grain
Hollow Point



4447
240 Grain
Soft Point



4453
240 Grain
Mag Hollow Point



4457
240 Grain
Mag Soft Point



4459
180 Grain
FMJ

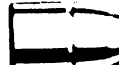
45 CALIBER (.451)



4477
200 Grain
Hollow Point



4479
225 Grain
Mag Hollow Point



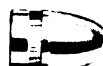
4481
260 Gr.
Hollow Point

32 CALIBER (.314)



4600
98 Grain
HBWC

9mm CALIBER (.356)

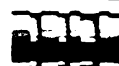


4601
125 Grain
Round Nose

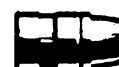
38 CALIBER (.358)



4605
148 Grain
BBWC



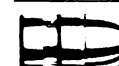
4617
148 Grain
HBWC



4623
158 Grain
SWC



4627
158 Grain
SWC HP



4647
158 Grain
Round Nose

44 CALIBER (.430)



4660
240 Grain
SWC

45 CALIBER (.452)



4677
200 Grain
SWC



4690
230 Grain
Round Nose



4683
250 Grain
SWC

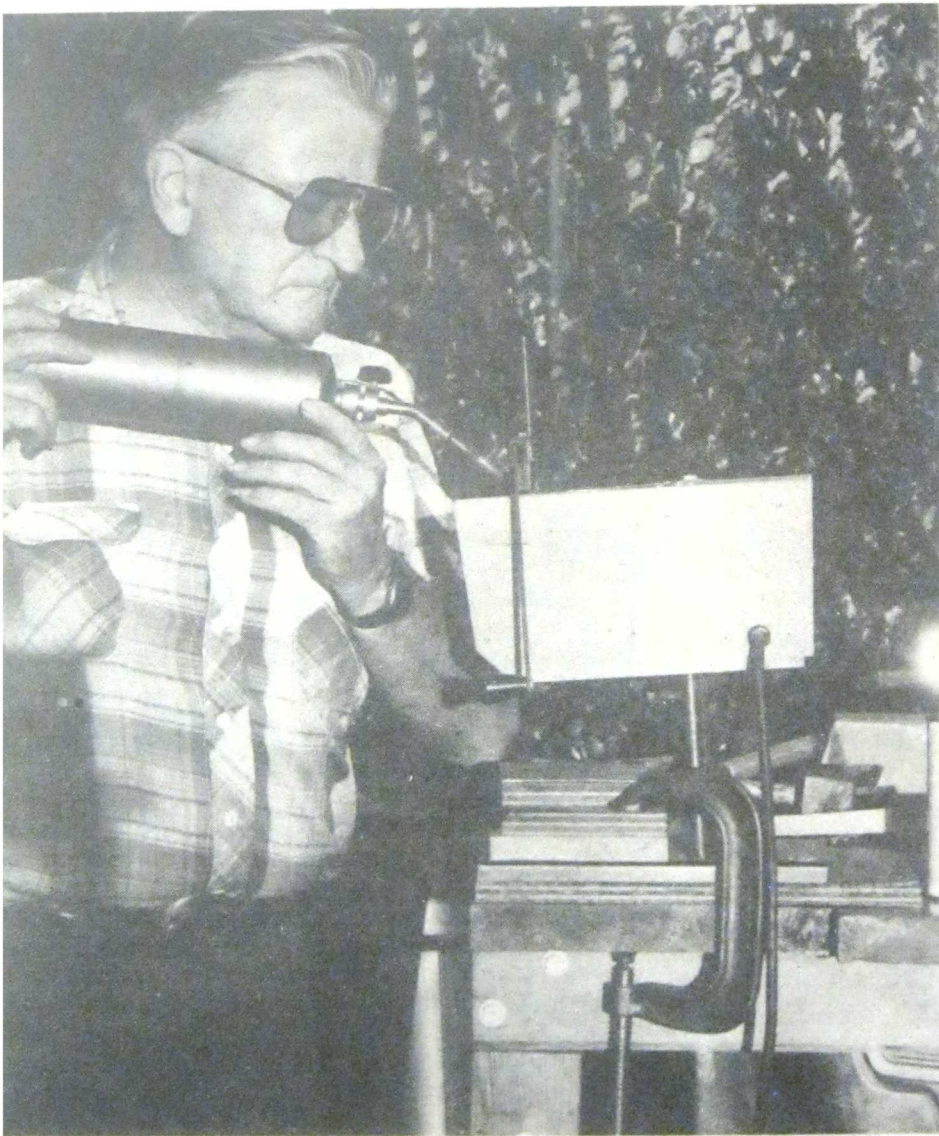
ROUND BALL



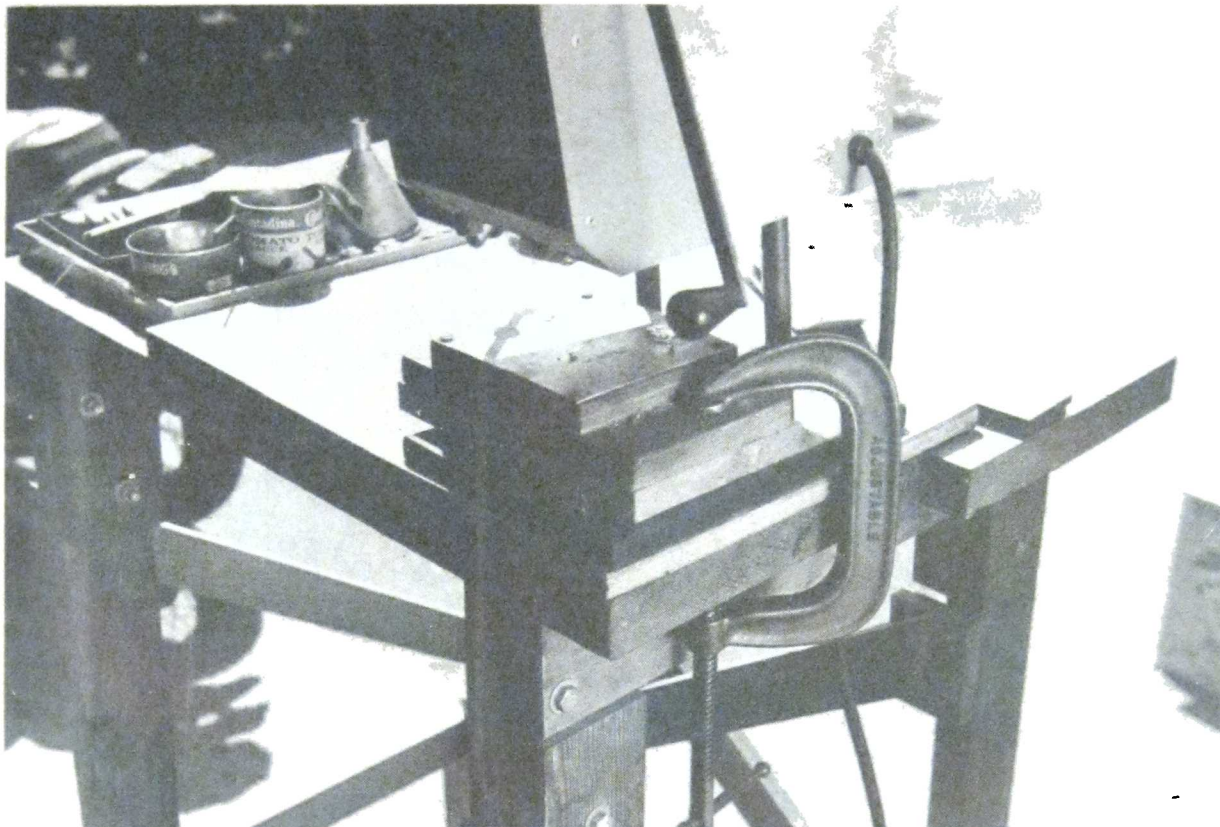
#5110 350"	#5137 457"
#5113 375"	#5138 490"
#5127 433"	#5140 485"
#5129 440"	#5142 530"
#5131 445"	#5150 535"
#5133 451"	#5180 570"
#5135 454"	

CASTING YOUR OWN BULLETS

Setting Up Your Private Bullet Foundry And Lining Up Sources Of Raw Material Frees You From Dependence Upon The Whims Of The Marketplace — So Far



If you're in a hurry to get going, you can hasten the melting by judicious use of a small propane torch, such as the one I'm using here. It's also handy for pre-warming mould blocks and many other chores. Note the use of shooting glasses: utterly mandatory when casting!



That's a piece of sheet aluminum screwed to the top of the plywood plate beneath the delivery spout of the RCBS Pro-Melt furnace. Spilled alloy won't stick to its surface. By adding or removing the pieces of board, I can vary the height to bring the sprue cutter close to the spout. The C-clamp holds it all in rigid alignment and prevents the melting pot from being knocked off the bench.

CASTING BULLETS is a fairly ancient art-form. In earlier works, I have noted that Shakespeare did an entire play about bullet casting: *The Trimming of the Sprue*. Seriously, it does have its roots sunk far back into the misty reaches of antiquity. Up here in the rarified levels of the Twentieth Century, we are fortunate to enjoy the fruits of all that research and development.

Having written upon the topic at hand at some extended length over three decades and a bit, and having scanned the feedback from those who bought and read the words, I've been made aware that bullet casting seems to be one branch of the reloading arts that poses more challenge than most reloaders want or need.

One gent, anonymous here by request and courtesy, is an upper-echelon executive of one of our largest and most respected producers of firearms. He has quizzed me on several occasions as to the reason he cannot produce a decent cast bullet, even though his life were at stake. I have suggested things to try and things to avoid, and given him extended personal counseling. The next time I bump into him at an arms show, I ask after his casting efforts and get saddled with further tales of woe. As this goes on — as it has for many years now — I'm becoming convinced there are souls for whom it is ordained in the stars that they just plain can't cast bullets. A sort of cosmic, "Not you, Clyde!" edict is in force to thwart and humiliate them.

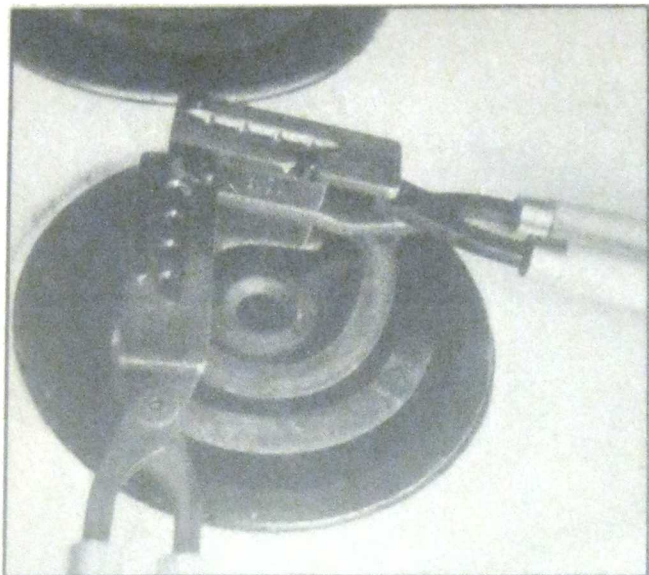
Fortunately, such star-crossed examples are much the exception rather than the rule and it is to be hoped you're not comparably cursed. There are few basic considerations and we're about to delve into those.

Good cast bullets can be produced if:

- The mould cavities are absolutely, tee-totally grease-free;
- The molten alloy is of proper composition, well fluxed and hot enough;
- You are patient and keep on trying until the mould cavities become *really* grease-free and properly up to temperature.

The two most popular materials for bullet mould blocks are aluminum and ferrous alloys. Ferrous means iron-bearing. A substantial percentage of iron in the makeup means it is capable of rusting, and probably *will* rust. Rust on the inner surfaces of a bullet mould cavity is a miserable thing. We have a universal truth here: Your most favorite bullet moulds are the moulds most apt to rust, no matter what you do to prevent it.

To avoid that calamitous contretemps, I spray my bullet moulds lavishly with the best rust-preventive medicine I can put my hands upon at the given moment. Miracle preservatives come and go. At this moment, I'm still putting my trust in Break Free. I am intensely concerned for the



Left: Another way to pre-warm bullet moulds is to put them on the burner of an electric stove, but do not overheat them as it could cause warping. (Below) Plastic mallet, spray degreaser, casting flux, pair of welders gloves and pliers are all handy for casting.

preservation of my moulds because quite a lot of them are cherished old designs that Lyman has discontinued. If I lose their services through rust or neglect, the odds are heavy I'll never be able to obtain a replacement for them. I regard that prospect as unbearably painful.

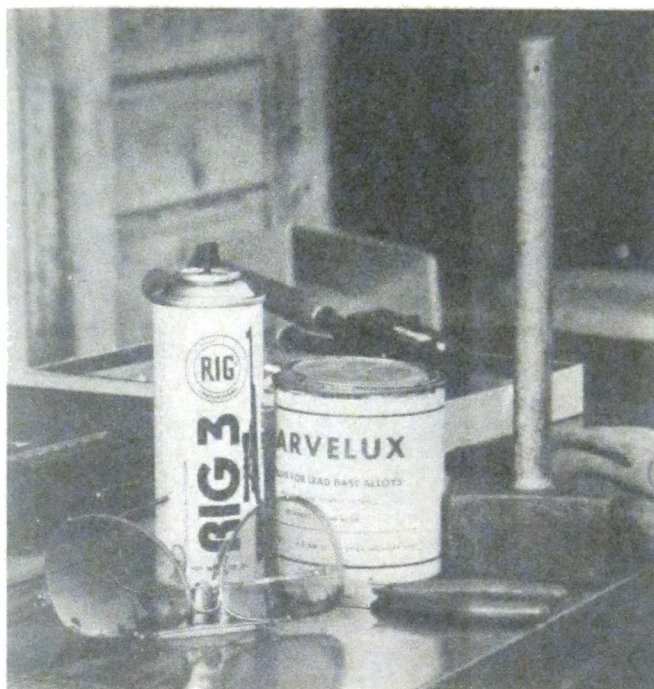
When it comes up the time to put some of these oily-glopped mould blocks back on the line to coax some more bullets out of them, I give them a liberal spritzing with a jet of pressurized RIG 3 degreaser. Again, if I knew of a better product for the purpose, I'd use that, instead. You can either order RIG 3 from RIG Products, 87 Coney Island Drive, Sparks, NE 89431, phone 703/331-5666, or you can get the words on a nearby local source.

Following the degreasing bath, I fire up a small propane torch and give the cavities a prewarming to burn out still more of any remaining residual hydrocarbons that still may be lurking about. So long as you still have even one lone molecule of oil (hydrocarbon) lurking anywhere near the cavity, you will continue to cast a bullet that resembles a sort of silvery raisin. I can confide that such bullets shoot at least as lousily as they look. Decant them back into the melting pot and give them another chance at immortality.

Never a drop a reject bullet directly from the mould back into the pot. If you do that, small spatters get up and attach themselves to the mating faces of the blocks and prevent full closure between the blocks.

It is possible to cast decent bullets by dipping out of a retired frying pan atop the family's kitchen range and I've produced some hundreds of thousands of bullets that way, by actual count. I do not recommend that approach. It stinks up the house and alienates other family members. It does not provide as much ventilation as you need, and you need a *lot* of ventilation.

We have come into a time when electrically powered, thermostatically controlled bullet casting pots are available from many sources at prices that are not inordinately outrageous, and I respectfully submit that is the way to go. If you prefer to dip from the top instead of dispensing from



the bottom by means of a valve-controlled spout, there are electrically-heated pots available for either mode. Many of them feature thermostatic temperature control that can be set to maintain the desired heat level. Within recent years, Brownell's have offered a thermometer suitably graduated for checking bullet alloy temperature and, more recently, Lyman has added a comparable instrument to their line. As I understand it, such thermometers are designed for brief, intermittent use. That's to say, you immerse the element, note the temperature and then set it aside until you wish to check the temperature again. If you leave them in the pot it may damage them.

ALLOY COMPONENTS

Three metallic elements — lead, tin and antimony — are the basic ingredients of bullet casting alloys. They vary as to melting points and density (specific gravity). They are relatively inexpensive, though not as inexpensive as we might wistfully wish. Let us list their characteristics:

METAL	DENSITY	MELTING POINT	CHEMICAL SYMBOL
Lead	11.4	621.3F/327.4C	Pb
Antimony	6.62	1166.9F/630.5C	Sb
Tin	7.3	449.4F/231.9C	Sn

A salvaged "squirrel-cage" blower directs a stream of air across the freshly filled mould to accelerate the cooling of the sprue; especially useful when casting large bullets, to keep the blocks from overheating. An electric fan would work as well. Blower was operating, but electronic flash fill at 1/5000-second stopped it.



As you will note, lead has much the greatest density and the melting point of antimony is considerably higher than that of the other two. It is a happy fact of life that an alloy will melt at temperatures substantially lower than the highest melting point of any single ingredient. That may not be true in every instance, but it is true of the Pb/Sb/Sn alloys we're currently discussing. Thus, with typical combinations of the three basic metals, a working temperature on the order of 680F/360C usually proves hot enough for practical purposes. If you push it much beyond 700F/371C, you will be burning out the tin as you go along and you need that precious commodity, which is the most expensive of the three in routine commerce.

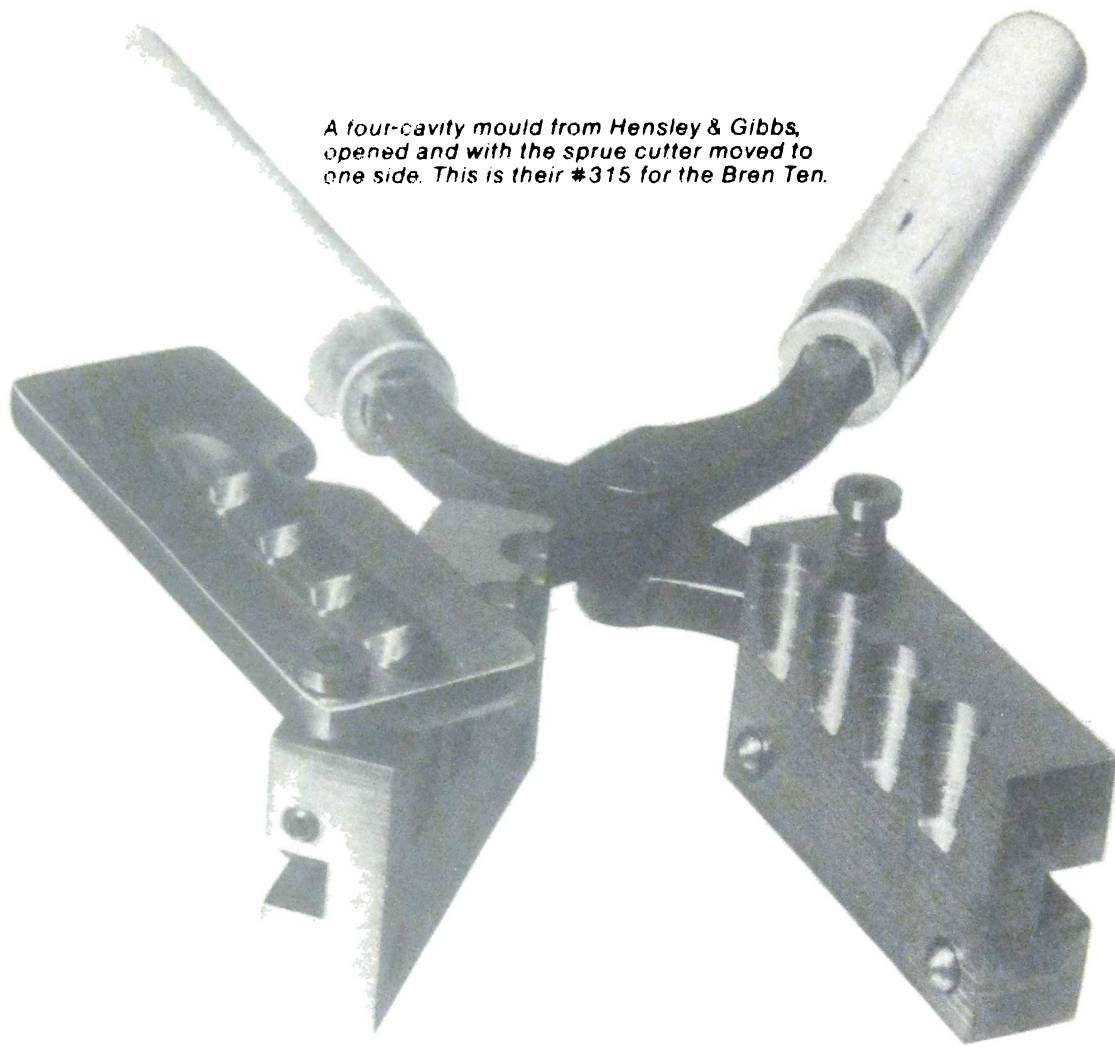
Pure lead, as the sole ingredient, poses considerable difficulty in obtaining a decent-looking bullet. If you try to drive it at any velocity high enough to be of interest, it will

rub off on the inner surface of the bore to deposit a fouling that resists removal quite stubbornly. If you add some amount of tin to the lead, the performance of the resulting bullets improve quite usefully. When you get to one part tin to ten parts lead, by weight, any further addition of tin serves no useful purpose.

A mixture of lead and antimony is quite unsatisfactory for bullet casting. As the bullet cools, the antimony solidifies first into crystals and those are surrounded by solidified pure lead, which will foul the bore just as remorselessly as if the antimony weren't even present. The problem is that antimony and lead do not solidify as a uniform mixture.

What we need to do is to add some tin to the mixture. Having a melting point lower than that of lead, the tin remains with the lead through solidification and preserves

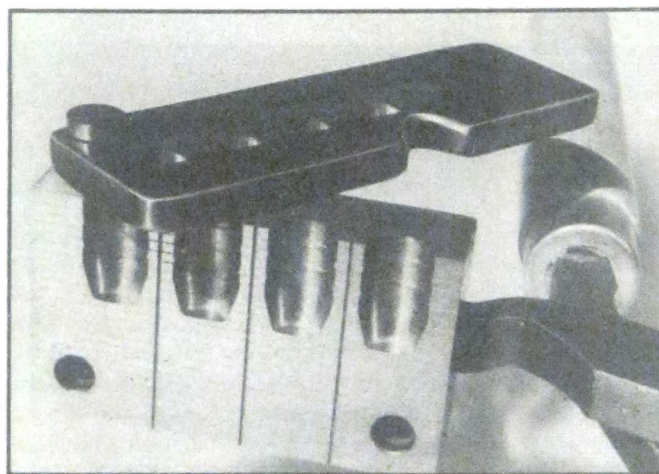
A four-cavity mould from Hensley & Gibbs, opened and with the sprue cutter moved to one side. This is their #315 for the Bren Ten.



a satisfactory level of hardness and resistance to bore fouling.

For the past many happy years, the bullet casters have enjoyed the benefits of being able to work with the by-product of another activity, namely printing. A number of years earlier — 1883 or so — a gent name of Ottmar Mergenthaler (1854-1899) invented the Linotype machine. For the next century, it was used to make up the lines of type for a great deal of the nation's printing activities. It's a big, complex gizmo, with a keyboard vaguely like that of a typewriter — except that the letters are arranged differently — and, as you type, it releases little brass moulds, all in a row. When you get to the end of the line, tapering fingers extend the spaces between words to result in justified copy, with even-edged right-hand margins and some amount of molten Linotype alloy flows down from the heated reservoir to cast the line of type.

The beauty of it was that, when you were finished printing from that batch of type, you could dump all the slugs back into the pot and use it to make up the type for tomorrow's news, at least for some given number of recyclings. After a time, the tin content burned thin and they'd run in some fresh ingots of Linotype metal and send the tired alloy back to the supplier of type metal. Alternatively, your friendly local printer might sell the stuff to a bullet



A closer look at one of the blocks in photo above shows the finely cut striations that serve as air vents.

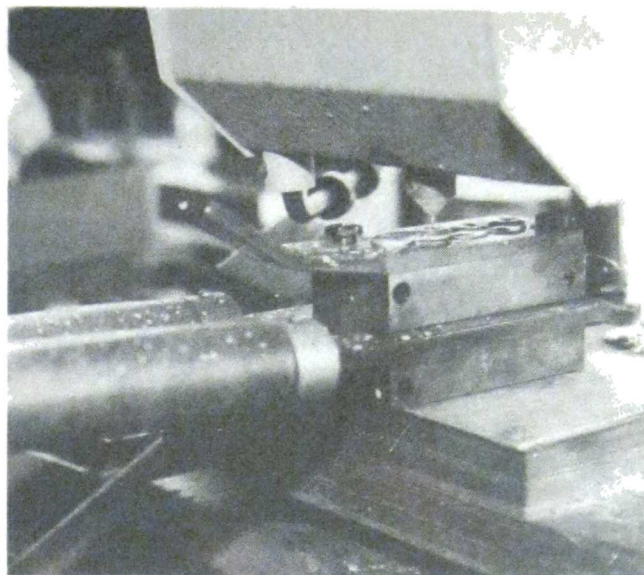
caster for the same allowance the type metal supplier offered and that wasn't an awful lot; perhaps thirty cents a pound, maybe a bit less.

Linotype metal, even if a bit use-worn, casts up into utterly splendid bullets and they perform in line with your fondest dreams, if not better. That's the good news.

The bad news is that Mergenthaler's ingenious creation is being phased out of the contemporary picture by the wonders of modern technology, none of which make use of Linotype alloy. Nowadays, they speak of "hot type" and "cold type" and the heavy emphasis is upon the latter: photo-offset printing, with the type coaxed out of computers, shot on page-neg's that use silver halides, but no plumbous (lead-bearing) alloys whatsoever. It causes the eye to dim and the breath to come in short pants.

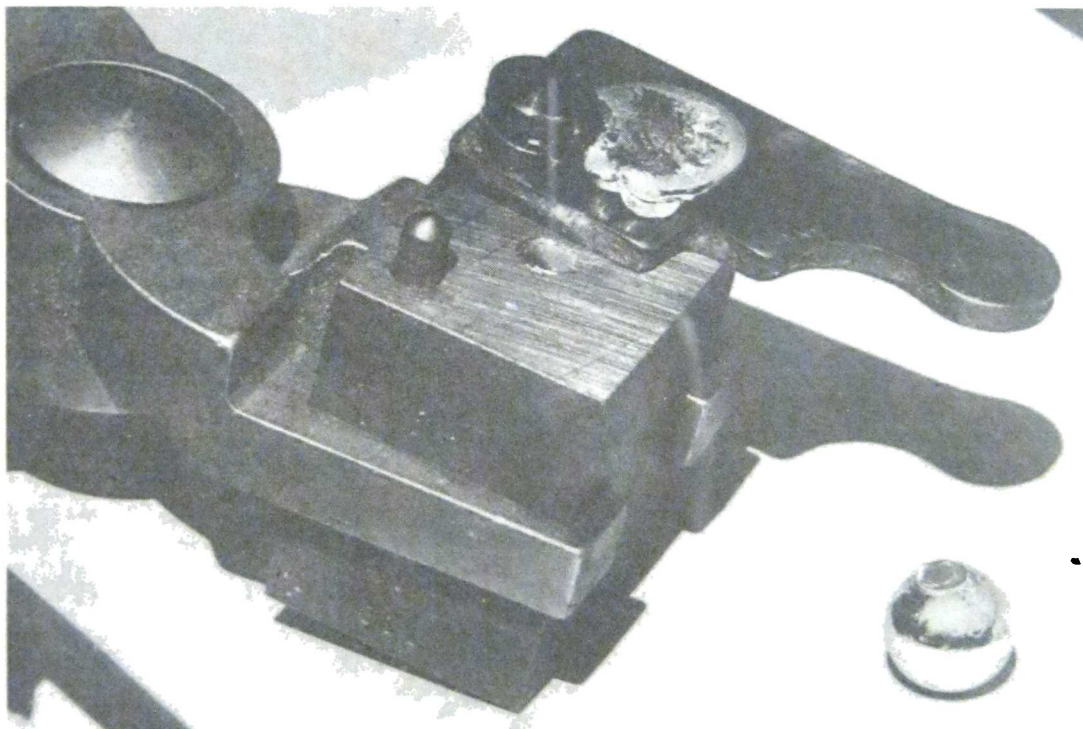
Even so, for yet a little while to come, there still are a few Linotype machines in operation, by-producing the by-product of which bullet-caster's dreams are made; but their number diminishes with each passing year. The day is coming when the last Linotype will be shut down for the last time and, from that time on, Linotype metal will go to join phlogiston on the roster of defunct compounds and the legion of bullet-founders will be much the poorer for it.

There is a remorseless force at work here. Not so many years ago, the plumbing in a typical house consisted of some amount of lead piping and lead-caulked joints. Today, much of that has been replaced by polyvinyl chloride (PVC) plastic and that doesn't cast up into bullets for sour owl-sweat. In the days of lead pipes, they were joined by



A four-cavity Lyman mould in the process of being filled. The utility of the supporting base is evident here, offering precision and avoiding wrist strain.

A single-cavity Lyman mould for the .440" round ball, with cutter knocked over and sprue still in position.



plumber's wiping solder — a mixture of sixty-five parts of tin to thirty-five parts of lead and, when a plumber ripped out the old piping, he'd cut the wiped joints out and toss them to one side, retaining the pure lead pipe for joint caulking. On being propositioned, the average plumber would sell you the accumulation of wiped joints for a trifling pittance and you could take them home to enrich your bullet alloys in the manner magnificent.

It pains me to come on pessimistic like this, but I can't avoid foreseeing the day when the nation's bullet casters come upon hard and dire times. Presumably, for yet some years to come, tire stores and garages will continue to balance wheels with the little wheel weights. If someone

discovers a plastic substitute for *that*, we've all got a problem and a bad one.

At one time, bars and taverns made use of coils of pure tin tubing between the barrel and the taps. These bore the generic terms of beer-coils and were replaced periodically, with the old ones going onto the scrap market at modest prices. I can't even begin to recall how many years have come and gone since I last encountered a beer-coil at scrap prices. For all I know, they've gone to join the dodo, buttonhook and free lunches.

My point is that, for many happy decades the bullet-casting reloader has been living high upon the cast-off by-products of assorted other activities such as printing and

plumbing. As a result, we've been able to scrounge up our raw materials at costs ranging from friendly on down to free. When/if the time comes when we have to shop upon the open market for the components of our casting alloy, the situation is going to become plumb downright traumatic. No pun was intended there.

Tin will pose the thorniest problem. Nearly all the tin used in this country is imported. There is only one small tin-mining area here, down in Texas, and it's quite unable to supply the country's needs. I don't know the current market price for reasonably pure tin, but suspect it's on the order of ten bucks a pound, probably more. Offhand, I know of no convenient source for straight tin, even if you can afford it. Comes the final pinch, you can buy 50/50 solder, which is half tin and the rest lead. The bar solder is cheaper than wire solder, but even the bar solder retailed at around \$11 a pound, the last time I priced it, and I'm still reeling from the shock of that.

Gil Hebard Guns, Box 1, Knoxville, IL 61448, used to list straight antimony in their catalog, but I've not seen one of their catalogs for the past several years and am not certain if they still do.

Lead remains reasonably available down to the present, but even that is not cheap on the open market. Many of these metals can be found listed on the daily commodity market quotations, but the price they list is not the price you'll have to pay for small amounts at retail, not by a long shot.

I can tell you of one source for scrap lead to avoid and please make careful note of it: storage battery plates or translating for the benefit of British readers, the lead whatsits out of accumulators. Even in the old days, battery lead was a poor source because it could and sometimes did embody pockets of (sulfuric) acid which could explode devastatingly when melted. At some vague point around

the Sixties or Seventies, battery manufacturers started adding a percentage of arsenic. One reason was to create the modern battery that doesn't require checking of the liquid level and occasional addition of distilled water. Even some of the add-water batteries, however, contain some amount of arsenic.

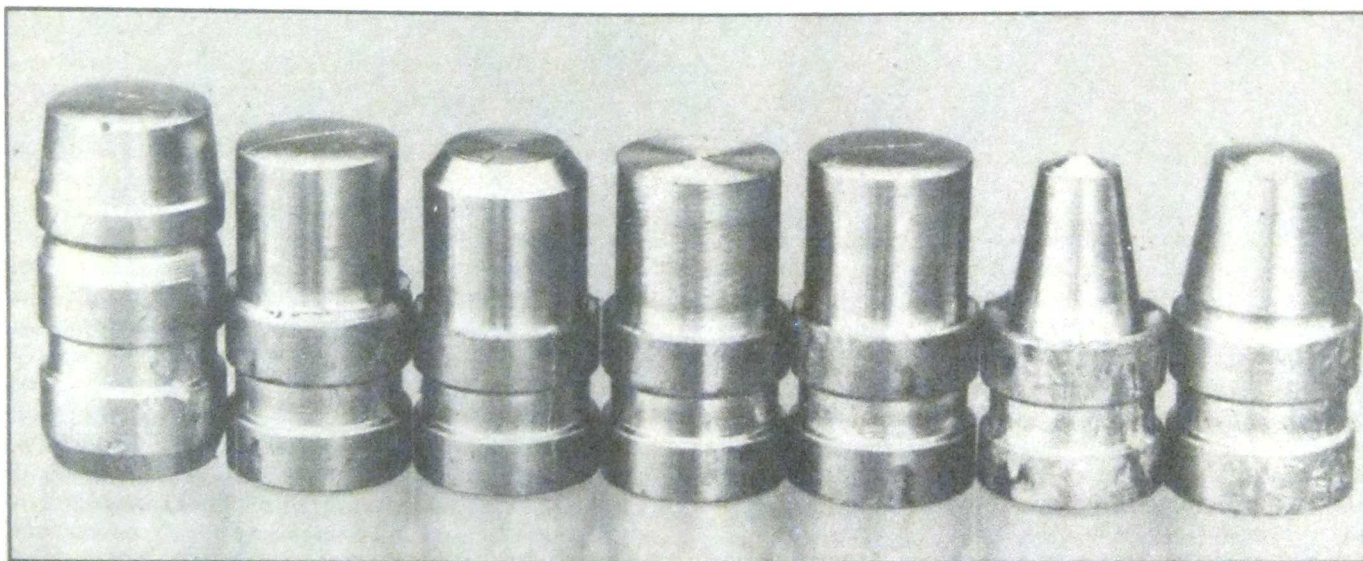
Arsenic, in its elemental metallic state, melts at 817C/1502.6F and has a density of 5.72; chemical symbol As. Like lead, it is inherently toxic, only considerably more so. The deadly hazard lies in the fact that, particularly in combination with antimony, it is capable of forming a poisonous gas that is fatal in concentrations of only a few parts per million (ppm). Put bluntly, trying to cast bullets from battery (accumulator) lead can kill you deadlier than canned tuna. You don't want that to happen and neither do I because I need all the readers I can hang onto. So avoid battery lead for bullet casting alloys, promise?

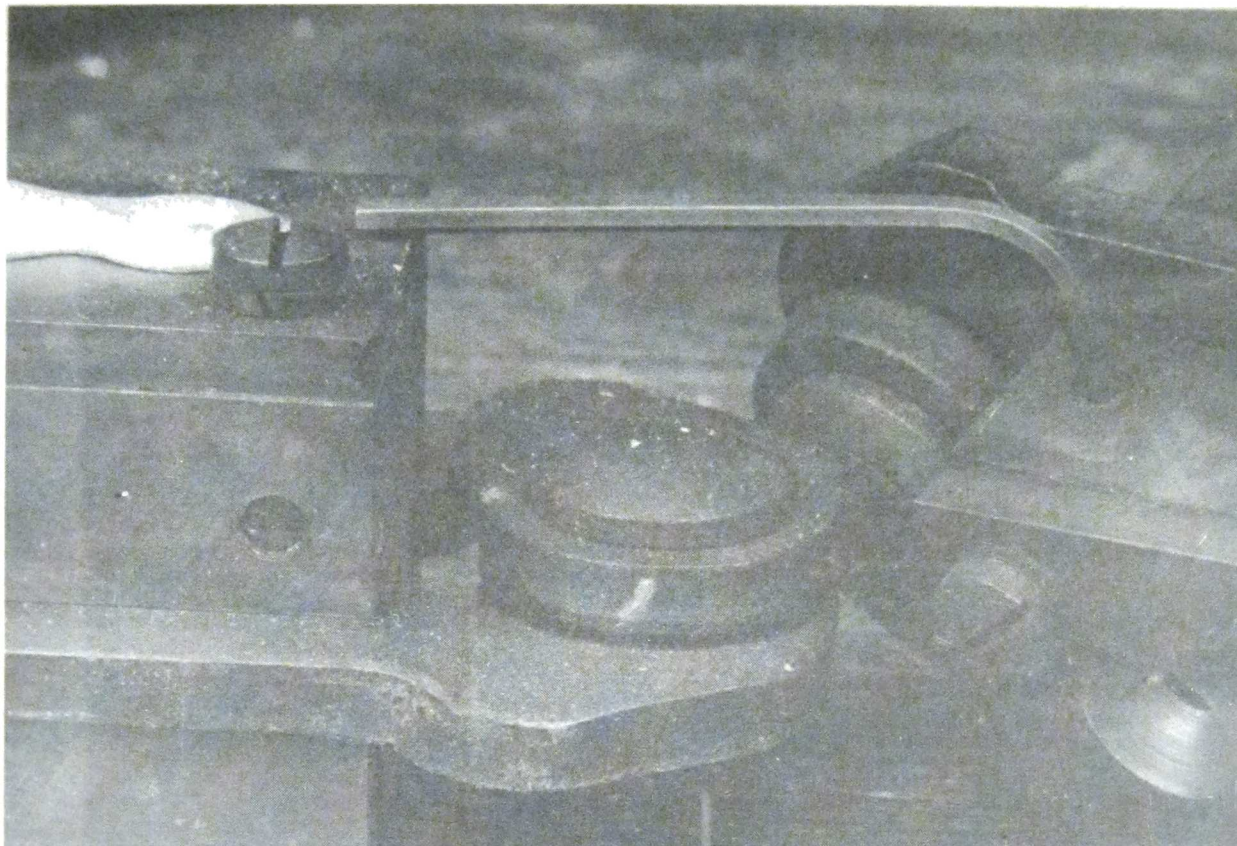
Our old friend, the wheel weight, remains the most economical source for the bulk of alloy makeup. What it costs is between you and your local tire store or filling station. It's mostly lead with a bit of antimony, and perhaps a trace of tin.

The wheel weight, as received, needs quite a lot of work before it becomes useful. You have to melt them down and skim off the little steel clips, and flux the remainder. You'll probably find it works best to run the cleaned metal off into pigs and set them aside to await further alloying. Several suppliers of reloading equipment offer pigs or ingot moulds. What I find works best of anything — if you can get it — is the stainless steel top half of an old GI mess kit. The two stamped depressions produce kidney-shaped pigs weighing approximately six pounds apiece and they are quite convenient to drop into the melting pot as you go along.

When first pigged up — if that's an acceptable verb? — let them cool down and mark the pertinent information on

When cast from straight Linotype alloy, it is possible to turn cast bullets on a lathe with acceptable precision if you fancy the idea of modifying the design for experimental purposes. The basic .44 Hensley & Gibbs #325 at left, sometimes termed the Gully-Gouger, has had its generous base bevel turned off and the six bullets at right display a like number of experimental "nose jobs," that could serve as the basis for a new bullet design.





Lyman four-cavity moulds have their sprue cutter holding screw anchored by a small slotted-head 10-32 screw, visible in the mould at left. It constitutes a useful modification to replace these with hex-socket set screws of the same 10-32 thread, enabling the caster to tighten the adjustment much more securely.

them with a felt-tipped marker. WWM makes a convenient abbreviation for wheel weight metal and the date of reclamation is also pertinent, I think. If you neglect that logical step, you'll wind up with lots of six-pound kidneys and no idea as to what may be the composition of any of them.

One pound of Linotype alloy, blended with six pounds of wheel weight metal, results in an alloy that usually produces quite decent and acceptable bullets. In point of fact, it's usually possible to cast bullets from straight WWM and they may perform reasonably well. They'll perform significantly better if you can sweeten the pot with a bit of Linotype, however. Consider a little bar solder, in a tight pinch.

I could give the composition of Linotype metal, as many sources do, but I'm reluctant because it is a loosely generic term, covering so many different blends of the three basic metals and perhaps others as well. Once, back in the Fifties, I purchased some stuff represented as Linotype metal. Tapped lightly with a hammer, it would ring like a great brazen bell. Hit it a little bit harder and it would shatter like glass, breaking to sharp crystalline formations. It was some kind of metal used in printing, but it certainly wasn't Linotype metal as we all know and love that good stuff.

I'm ruefully aware that much of the foregoing discussion sounds rather vague and amorphous. I'm sorry about that, but I hardly see any ready way to avoid it. The basic operation of gathering up likely-looking quantities of metal, blending them into an alloy and casting bullets from them is, by

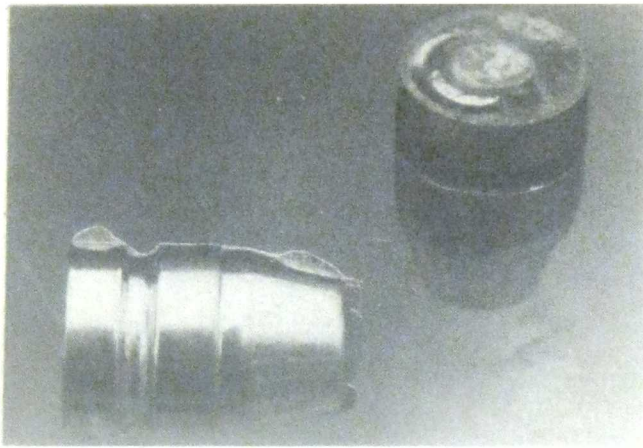
its unchangeable nature, more art than science. Rarely, if ever, will you come into possession of a quantity of metal and have much more than an intuitive hunch as to its composition.

There is a pragmatic or perhaps empirical approach that can be followed: If it looks likely, melt it down and try casting some bullets out of it. If they look good, load them into cartridges and try them out. If they work well, cast it up and use it. If they're not up to snuff, but show some amount of promise, enrich them with additives known to be helpful and try again. Repeat as may seem indicated. Make note of later comments.

Another metal source I've not mentioned to this point can be termed range lead. Periodically, some of the larger shooting ranges mine their backstops, pick out the slugs, and either melt them down or sell them as-is. Some of the skeet and trap ranges do the same to reclaim their fallen shot.

Shotgun pellets are nearly all lead, along with a small amount of antimony to create the so-called "chilled" shot. You can pass those by for casting bullets, unless you're able to add a quantity of tin.

Salvaged bullets from rifle and pistol ranges may prove pleasantly surprising. Note well that I say "may." If obtained in the form of melted-down pigs, you can expect a sizeable portion to be composed of the cores of jacketed bullets which are nearly pure lead. If it came from a police range, most of the bullets went downrange as respectably decent cast alloys and the reclaimed run should not be far,



Cast bullets require inspection and rejection of defective specimens, such as the two shown here.

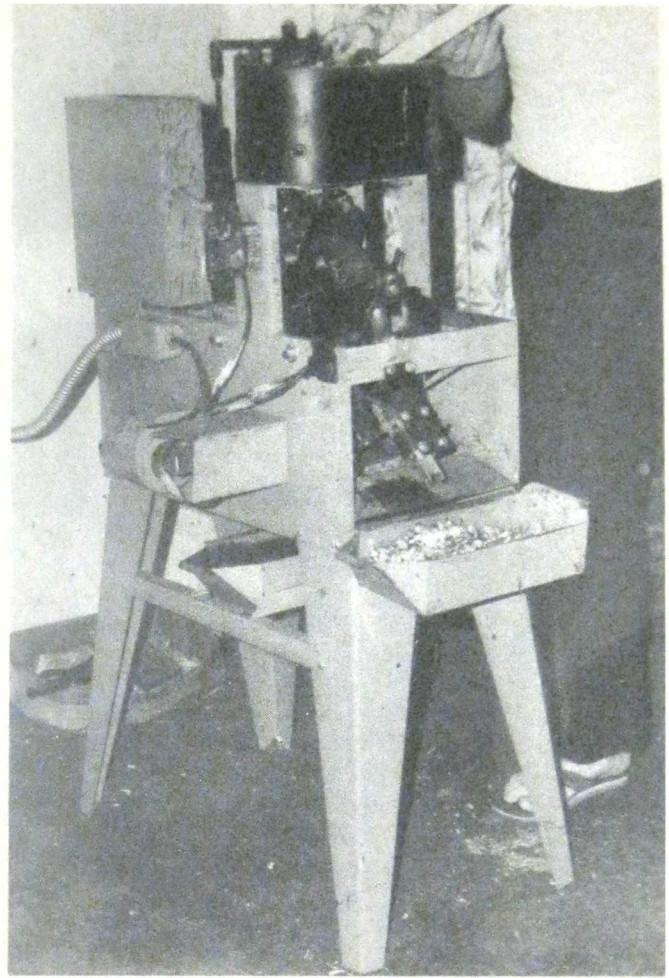
off the desired mark. In any event, it's a Hobson's Choice, potpourri. Duke's mixture sort of thing and I can't offer much helpful guidance for reasons that ought to be glaringly obvious.

The operative procedure remains the same in all these possibilities: Melt some down and try casting bullets from it. If the results seem grotesquely unsuitable to your needs and wants, do not try to salvage the batch by adding Linotype and similar enriching ingredients. You may have come up with some metal hopelessly contaminated by metallic elements inimical to bullet casting. Example: The solder used by telephone crews on cable sheathing contains something — I've never yet established exactly what — that gives casting alloys the consistency and general properties of cold oatmeal. There is no way I've learned to date to cleanse and salvage it. If you throw in some perfectly good Linotype metal, or even pure tin, it still refuses to make a decent bullet, or even a marginally indecent one.

If you come into possession of metals such as that, I can only suggest you pig them out with the mess kit top or whatever, label them clearly and set them aside for future use as ballast, gluing weights and similar, non-critical employment.

In the chapter currently scheduled as Chapter 21 — "Math for the Reloader" — I plan to pick up and repeat a full-page table of properties of the metallic elements that I cranked into *Gun Digest Book of Autoloading Pistols*. It affords a lot of useful and thought-provoking dope on the ingredients that, conceivably, could be used in compounding bullet casting alloys.

There are many questions I wonder about but cannot answer. For example, has anyone ever looked into the possibility of alloying mercury with lead/antimony/tin? It is heavier than lead and presumably would lower the melting point. Would the mercury migrate out of the cast bullet to form amalgams with the brass cartridge case, crystallizing and weakening it? Mercury is another of those metallic elements with toxic properties it's never bothered to uncrate to the present. Sometimes they can be controlled, as exemplified by the silver fillings once and perhaps still



If you want lots of bullets, the automatic casting machine from Magma Engineering Co. may be the way to go. This is one of the units in use by S&S Precision bullets and yes, you're right: That is not a canny choice of footwear around such equipment!

used for filling teeth.

Various researchers have looked into the possibility of hardening cast bullets, and have issued glowing reports of success at it. The techniques include dropping the bullets out of the mould into cold water, taking suitable precautions to prevent a droplet from splashing into the pot of molten alloy, which would explode into steam and cause a Vesuvius of alloy.

Others put the cast bullets into an oven and bake them an hour or so at some specified temperature, then decant them into cold water. It's emphasized that this must be done after the bullets have been sized because, in being sized, they lose every last bit of acquired hardness. Obviously, they can't be lubricated before heat treatment because the lube would all come off in the process.

Still others, or some of the same, have reported that bullets of typical alloys acquire additional hardness after aging for a matter of months.

One thing continues to puzzle me about all this: If bullets lose their hardness when shoved into the sizing die, then what happens to all that hardness when you blast the bullet up through the rifling of the bore?

Purely out of curiosity, I've tried dropping the freshly

cast bullets into water and have tested them against loads put up with untreated bullets. I was unable to detect any difference in grouping ability between the two lots. Of course, I lube-sized the water-dunked bullets and some would say that nullified any gains.

What is the advantage sought by hardening cast bullets? Presumably, it's to enable higher velocities without objectionable bore fouling. Do we need that? I'm not certain. See what you think:

In working with the .357 Remington Maximum, or R-Max, cartridge at the time of its introduction, I cast up some Lyman #358429 bullets from an alloy of four parts antimony and one part lead, by weight and they came out weighing about 167 grains. As cast and lube-sized, they tested 10 on the Saeco hardness tester, the top of that instrument's scale. Note that that was *after* lube-sizing.

I loaded the bullets into the R-Max cases ahead of 24.4

grains of Hodgdon H110, using the CCI-550 magnum small pistol primer and tried the load through three guns: a 10½-inch Ruger Blackhawk and Thompson/Center Contenders with barrels of ten and fourteen inches. Average performances were:

10½-inch Ruger Blackhawk	1873/1301
10-inch T/CC	1965/1432
14-inch T/CC	2049/1557

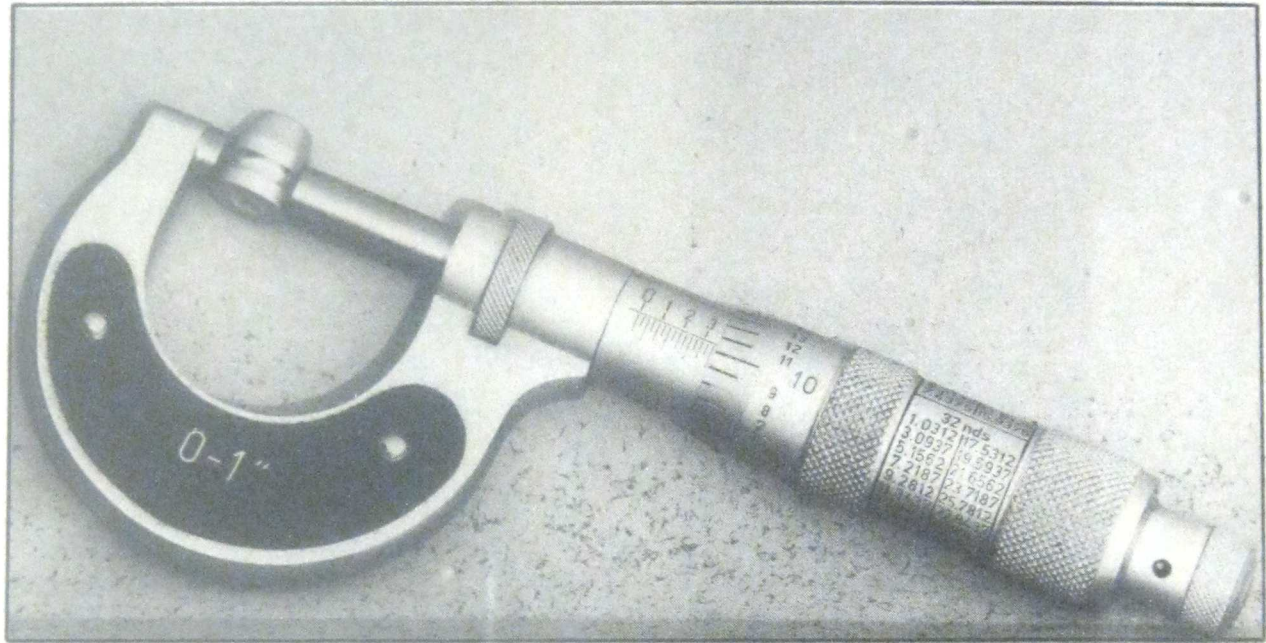
From the ten-inch Contender, the load put five into a spread of hardly one inch at twenty-five yards and extensive firing turned up no detectable problems from bore fouling, even at the 2049 feet per second (fps) pace out of the Super-14 Contender barrel.

The Lyman #358429 is a plain base, semi-wadcutter design; not even fitted with a gas check. It was designed for



Raw material and finished products awaiting further attention at S&S Precision Bullets.

The bullet being measured below is a discontinued Lyman design for the .380 ACP or 9mm. It mikes about .3605-inch, as cast. That will be reduced to .356 in lube/sizing or, if desired, to .358 for use in revolvers.



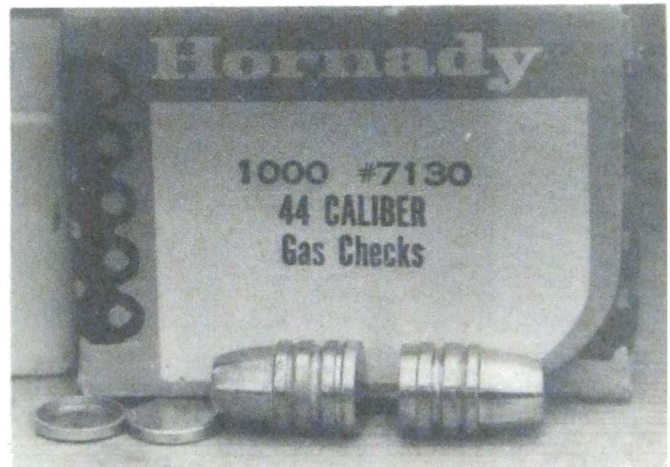
Lyman by the late and revered Elmer Keith, who never cared much for gas checks.

It's pertinent to note that I used the bullet lube originally developed by Choate and currently produced by S&S Precision Bullets (22965 La Cadena, Laguna Hills, CA 92653). It is composed of beeswax plus lithium-base grease and contains none of the magical Alox. I find that this lube does its job extremely well and have used no other for a long time. Alox is good stuff, too; I've used a lot of it with satisfactory results. I believe the lithium-base lube is just as good and, I think, a little better and that's why I use it.

CAUTION: *The mentioned R-Max load — 24.4 grains of H110 with a 167-grain cast bullet is not as yet sanctioned by any reloading manual and I do not recommend its use by others. Anyone who uses this load does so specifically at his/her own risk and discretion!*

Having discussed bullet casting and side topics at length, let's consider the typical start-up and procedure for a casting session. Weather permitting, I prefer to cast outdoors, for the sake of adequate ventilation, but one must take extreme care that a sudden shower or berserk lawn sprinkler doesn't put a drop of water in on top of the molten alloy. It will blast lead all over the place. Be sure you're wearing your shooting glasses or face mask and such other protective clothing as you see fit.

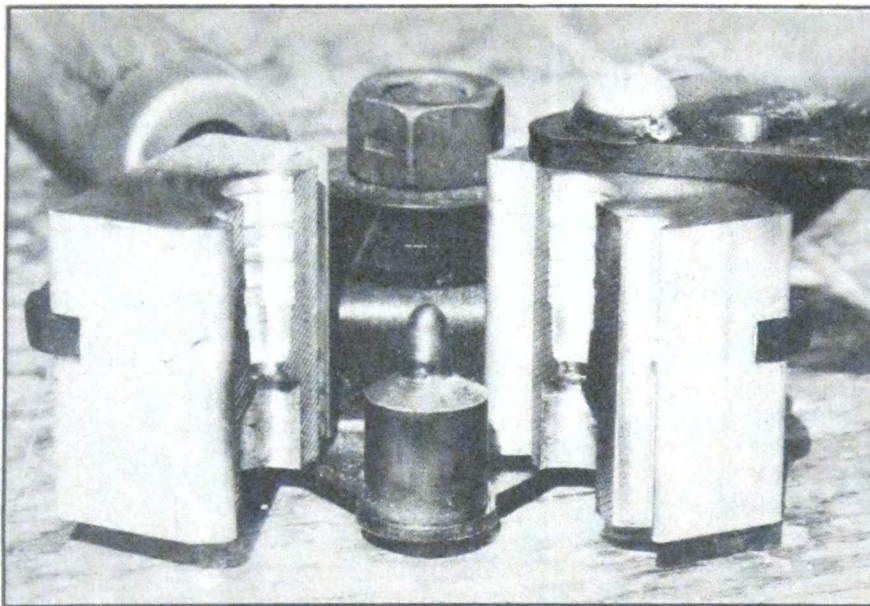
Small side equipment includes a stirring stick, a grundgy old spoon, a pair of pliers, a screwdriver, a can of Marvelux casting flux, an old tin can for the skimmings and some flat cardboard trays; one for the sprues and another for the



This is Lyman's excellent #429415 for .44s, designed for use with a gas check, two of which are seen at left and a third is installed on the bullet at left. Gas checks enable bullets to be driven to higher velocities.

finished bullets. Last, but far from least, is a suitable mallet for knocking the sprue cutter aside and tapping bullets free of the mould blocks. When casting large bullets in hot weather, I bring out a small centrifugal fan to hasten the solidifying of the sprue and help to keep the blocks from overheating.

An old piece of three-quarters-inch plywood goes on top of the bench and underneath the melting pot and then I use



An ingenious design from Lee Precision positions a hollow point pin permanently in the mould. These are available only in the single-cavity version and work well.

a large C-clamp to secure the pot to the board and bench. On one unforgettable occasion, long ago, while working in the driveway, a large St. Bernard dog saw one of our cats, wrenched the sturdy lead chain out of its mistress' hand and came through the stuff on the drive like a squadron of Hannibal's elephant corps, with the chain threshing about like a great flail. I think of such things and decide I don't want the pot knocked off the bench. Even barring such a distraction, I'm painfully clumsy and prone to bump things over.

I bring out a sturdy extension cord with ground wire and three-prong sockets, which is plugged into a fuse-guarded outlet on a bench in the shop. I plug in the cord of the pot and turn on the little cut-off switch, turning the thermostat dial to about 800F.

If the alloy level is low in the pot, I add a few ingots or pigs of alloy from the rack or bins, thankful I took the bother to identify the mixture(s) when I made it up earlier.

If I'm in a hurry, I fire up the propane hand torch and play the flame down on and around the metal in the pot. The RCBS Pro-Melt pot is the one I usually use, but I have two other big pots, a Saeco and a Lyman, as well as a few of the smaller Lee Precision pots and use any/all at various times. The main motive for using the Pro-Melt is because of its large capacity and rapid ability to get the metal melted.

With the metal on its way to liquid state, I get out the moulds I plan to use. Often that involves finding one set of blocks and a pair of handles to fit them. Usually, the handles will have some other pair of blocks installed. That's why we needed the screwdriver, with a blade about 3/16-inch wide. With the proper blocks installed, I give the cavities and sprue cutter a liberal flushing with RIG 3 degreaser, followed by a few blasts from one of the handy little blow cans sold in photo stores under trade names such as Dust-Off. That blows the excess solvent off the blocks and dries them.

I fire up the propane hand torch again and gently warm the inner surfaces of the cavities and the underside of the

sprue cutter. Discretion is the word, here. You don't want to overheat them, lest they warp and become damaged. What you're trying to do is to burn out the last of the oils and other hydrocarbons, as discussed earlier.

Setting aside the moulds, I open the can of Marvelux and scoop forth a small amount of the crystalline white powder on the tip of the stirring stick. This is dropped onto the surface of the molten metal and the stirring stick is slowly and carefully pushed down in before commencing to stir. It's not uncommon for infinitesimal bits of moisture to be present on the roughened end of the stick — which was once the stainless steel handle on a family soup ladle — so go easy and be sure you're wearing eye protection.

As you stir in the Marvelux, you may seem to feel the alloy become easier to stir, thinner, more liquid. Stir, moving the stick up and down, to carry the flux down into the pot as best you can manage. Give attention around the sides with the tip of the stick to bring the stuff to the surface. Skim it off with the old spoon and drop it into a shallow tin can. Do not discard the can of skimmed alloy dross in the family trash barrel, particularly one with a cover. Moisture, getting in contact with the dross, can form the deadly gas mentioned previously, setting a death trap for some poor innocent who reaches down into the barrel. That's if the alloys contained amounts of arsenic and how can you be really certain they didn't? Especially if you're using reclaimed range lead or other presumably meltable materials of unknown origin? What to do with it? I usually dig a hole and bury it, after accumulating a moderate amount, but I'm not convinced that's the ideal way to dispose of it. Toxic wastes are a growing problem in the modern world.

Getting back to the topic: The metal is nice and clean, fairly well up to the 800F thermostat setting. We'll leave it there for just a little while yet, until we get the moulds warmed up and producing, making a mental note to set it back down and reminding ourselves that Samuel Goldwyn may, or again may not have once snorted, "A mental note ain't worth the paper it's printed on!"

There are two basic approaches for casting from a bottom-delivery pot such as the Pro-Melt: Hold the delivery

nozzle within about three-eighths-inch of the hole in the sprue cutter and let the alloy find its own way; I think of that as the air-pour method. The other way is to hold the hole in the sprue cutter snugly up against the nozzle and open the valve for a brief time: I call that pressure-casting. Both have advantages and drawbacks and much depends on the nature of the mould as to which will give the better results.

Until the mould blocks get really hot, with the last of the contaminants burned out, bullets cast by the air-pour approach tend to be poorly filled out, with a lot of specimens needing to be discarded. That's why we have the pliers handy: to move the rejects back into the box with the sprues.

Pressure-casting, on the other hand, tends to produce a number of bullets with air cavities in the bases. You will note these when you knock the sprue cutter aside and you may be able to swing the cutter back into place and dribble a bit of alloy in to fill up the hole. It's worth a try and sometimes it works.

The Pro-Melt, as do most other such machines, has an arrangement for regulating the amount the delivery valve opens and you can experiment with the adjustment to find the setting that works best.

After some amount of use, the bottom delivery spout nozzle may become clogged with alloy residue and require cleaning out. I'm not sure if it's the sanctioned technique, but I usually do that by holding a small nail in the pliers and forcing it up into the nozzle. Take care not to damage the valve tip or you'll end up with a leaky nozzle.

You will want to develop an efficient system for going through the various steps of casting. As customarily set up, the arrangements favor holding the mould handles in the left hand, the casting mallet in the right and using that one to manipulate the valve handle. After filling the cavity/cavities, observe the surface of the exposed sprue as it cools. You should be able to note the moment it shifts from a silvery appearance to a whiter, roughly crystalline look. That may or may not indicate it is fully solidified. Try tapping the surface of the sprue gently with the end of the wooden mallet handle. If it dents easily and oozes silver, wait a little longer until it doesn't do that, then knock it aside.

Tap on the end of the sprue cutter opposite the pivot pin to cut off the excess alloy and knock the cutter aside. Don't try to do it all with one mighty whack. You'll soon learn the force required to get it done in four to six raps. Multi-cavity moulds require more tapping than do single-cavity ones.

Two shallow cardboard trays have been set beside each other to the left of the pot on the bench top. The sprues are tapped into the one nearest the pot, the bullets into the other. The purpose of the cardboard is to protect the still-soft bullets from impact damage and to protect the finish (if any) on the bench top.

When the times comes to dump the accumulated sprues back into the pot, be sure your eye-protection is in place and use the stirring stick to coax them out of the corner of the tray.

By this time, it's to be hoped that we've remembered to turn down the thermostat to typical operating range; say around 650-700F. At the latter temperature, you'll need to flux more frequently: every twenty minutes or so, perhaps more often.



Break Free is a good rust-preventive for ferrous mould blocks. RIG 3 is good for getting it back off.

When you return the sprues to the pot, or when you add more pigs of alloy, it will lower the temperature substantially, depending upon the amount and the working temperature. This may be signaled by the delivery spout freezing up and you can hasten its return to service by heating it with the propane torch. That brings up another of those sidenotes:

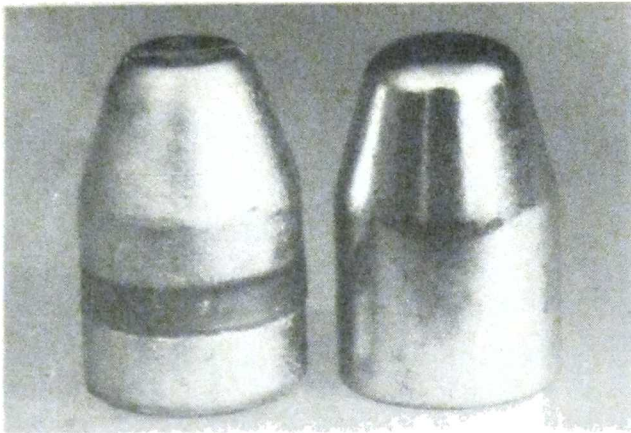
Propane torches: Make it firm and inflexible practice to unscrew the burner assembly from the tank when the torch is not in use. I've had several of these handy little tools and have yet to find one that wouldn't leak the tank empty in time if the burner were left installed. That wastes fuel, of course, but what's worse is that propane, like most such fuels, is slightly heavier than air when loose on its own initiative. Without air circulation to carry it away, it can lurk about in wait for the unlucky spark. When thus set off, it can do spectacular damage, comparable to a few sticks of dynamite, if there's enough of the stuff involved.

To this point, we've been concerned with getting the cavities utterly grease-free and nicely warmed to the task at hand. How soon that happens will depend upon the ratio of the volume of the bullet(s) being cast compared to the volume of the mould blocks. When casting 240-grain .44 slugs in a four-cavity mould, it doesn't take long at all. When doing light .22s in a single-cavity, it can take a *lot* longer.

Most cans can and do become overheated. You'll be able to tell when that happens by the increasingly "frosty" appearance of the finished bullets. Likewise, if you get overly hasty to knock the sprue cutter aside, the sprue may still be in a semi-liquid state and that will be indicated by building smears of silvery arc(s) on the lower surface of the sprue cutter. After a certain point, such deposits will prevent close contact between the cutter and the blocks and you may start getting a shallow rim on the bullet bases.

Lead smears on the lower surface of the sprue cutter can be removed with a single-edged razor blade wielded with delicate care to prevent damage to the surface of the cutter.

Heat loss and/or transfer is a direct function of tempera-



Saeco's #377, left, for 9mm, duplicates the highly accurate, so-called Hornady/Air Force design, right.

ture difference. Blocks will cool faster/get hot more slowly on a cool day than on a hot one. Not surprising, when you think of it. The number of grains of lead alloy you're processing at each cycle likewise has a direct bearing on the running mould temperature.

Thus, as noted, on a hot day, when casting heavy bullets in a mould with four cavities or more, a small fan or similar device for air-cooling can be extremely helpful. It wants to direct its airstream downward so you can slide the just-filled mould blocks beneath it for some given number of seconds. Count, "One thousand and one, one thousand and two," if you like. I used to say, "One chimpanzee, two chimpanzee," and so on, but grew tired of having to put up with all those chimps about the place and shifted to thousands...

The fan-cooling approach seems to work out better than trying to accomplish the same thing by lowering the setting of the thermostat. At the lower heat settings, the quality of the fill won't be as good and you'll still have to wait an extended while to avoid the frosty bullet syndrome. Do the frosty bullets shoot as well? I really can't say with certainty, but the appearance of them bugs me.

The Pro-Melt furnace comes with a handy little adjustable mould guide that can be set to steer multi-cavity blocks beneath the nozzle with excellent accuracy. It works fine with Lyman, NEI, SSK RCBS and Saeco moulds, but I use Hensley & Gibbs moulds a lot of the time and they have protruding screw heads on the bottom of the blocks which hang up on most such guides. I have spoken to Wayne Gibbs about the matter, but have made little impression in doing so.

So I usually just fold the mould guide to one side, out of the way and use a stack of small pieces of three-quarters-inch plywood to bring the sprue cutter up close to the delivery nozzle. The top piece has a covering of .025-inch aluminum held in place by small sheet metal screws at each of the four corners. It serves multiple purposes: For one thing, it prevents wear and abrasion on the surface of the wood. For another, drops and dribbles of alloy won't stick to aluminum and can be brushed to one side with a flicked end of the stirring stick or whatever. The stack of spacing blocks is likewise secured to the bench and pot with the C-clamp so everything stays in its proper place.

At least one manufacturer — who requests anonymity here — has been experimenting with mould blocks made of

materials such as brass or stainless steel. Lee Precision and North East Industries (NEI) use aluminum alloy for their mould blocks and NEI uses the same material for the blocks they manufacture for exclusive distribution by SSK Industries — J.D. Jones' enterprise.

One might assume that aluminum mould blocks would be really great and I won't say they aren't, but they do present some amount of challenge. Down the many years, I've seen assorted fluids intended for coating mould cavities come and go. Ostensibly, they are intended to produce better bullets with less problems. Some have advocated smoking the inner cavity surfaces with a candle flame, cigarette lighter, or whatever. I have tried all such encountered approaches with bright hope in my heart, but have had no success worth reporting with any of them.

It is possible to produce a pretty decent bullet with aluminum moulds. I'd be inclined to say it's slightly more difficult than with most moulds made from ferrous alloys. I don't think it's due to the nature of the aluminum, but rather to the greater difficulty of getting the last of the oils and hydrocarbons eradicated completely.

In the matter of rapid conduction of heat, metals such as aluminum, copper, silver, and copper alloys such as brass or bronze are far ahead of ferrous alloys. That is not necessarily good news from the bullet caster's viewpoint. On an iron-based block, the heat stays closer to the cavity surface longer, which is more or less what you want; at least, up to a point.

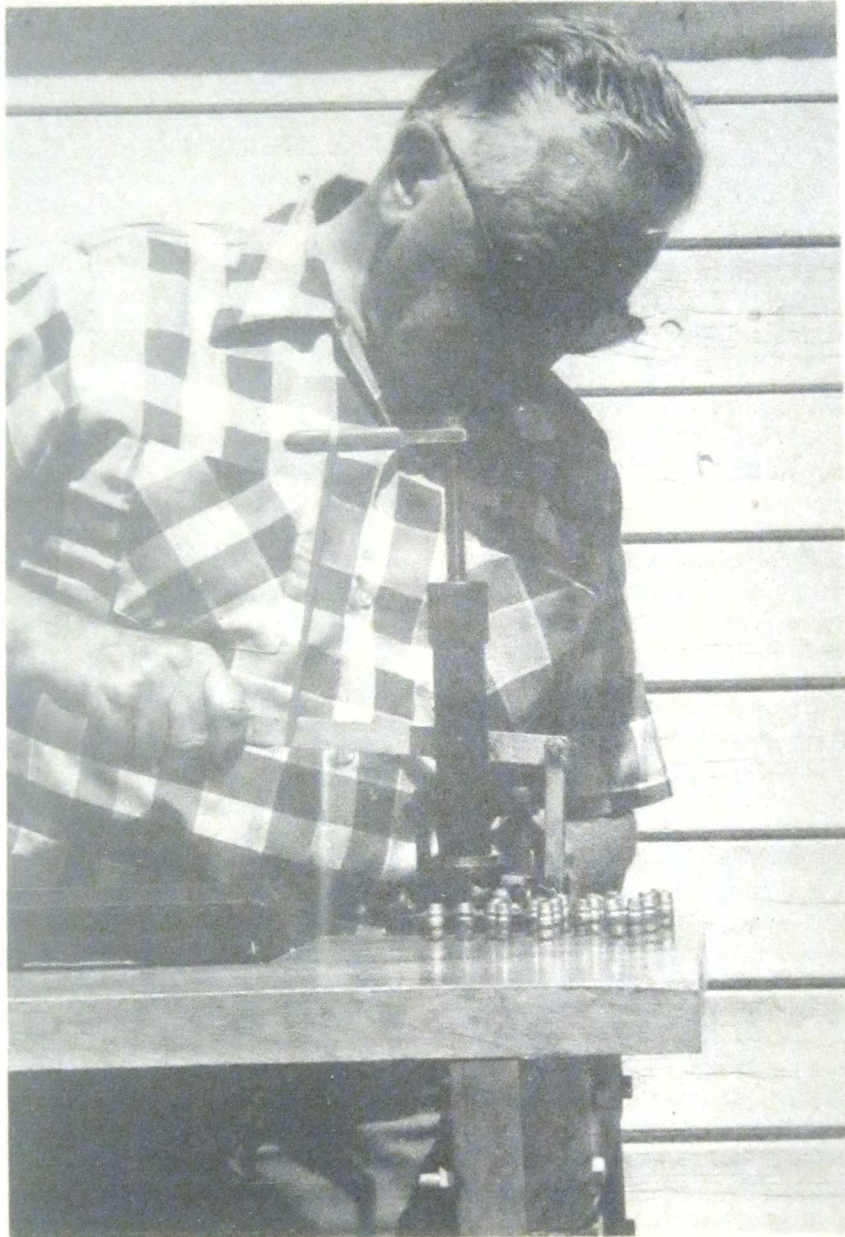
In theory, aluminum won't rust. In point of hard fact, it *can't* produce ferrous oxide, by which term rust is properly known. Aluminum, however, can and surely does acquire a patina of tarnish, and aluminum bullet moulds can do just that. It builds to a certain point, but rarely beyond that, unlike rust, which goes onward, ever inward with disastrous effect.

Apparently, some manner of cutting fluid is used in creating mould blocks from aluminum alloy and residual traces remain in the cavities upon receipt. Getting them out is the real challenge. J.D. Jones suggests removing the sprue cutter — practically always made of a ferrous alloy, along with its pivot screw — and boiling the blocks for some suitable while in water to which a small amount of dishwashing detergent has been added. You do that before trying to cast with the blocks for the first time, according to Jones. It sounds as if it might work. I blush to confess I've not as yet gotten around to trying it.

What I have tried, with pretty decent success, is flushing the cavities with RIG 3, followed by judicious torch warming, followed by a long hard casting session and, quite often, this results in some eminently acceptable bullets.

Jones suggests storing the aluminum mould blocks — without application of oils or other preservatives of any sort — wrapped in aluminum foil between casting sessions. Again, I think that has the sound of a good idea.

I'll repeat for emphasis that lead is a toxic material and one must avoid any activity while casting, lube/sizing or loading lead alloy bullets that might bring lead from the fingers to the mouth and on into the system. Don't smoke, don't eat and don't even try to dislodge a raspberry seed from between your back molars with a fingernail. Painter's colic awaits those who disregard such sensible precautions; with or without the apostrophe!



LUBE/SIZING CAST BULLETS

**This Operation Is Quite Necessary To
Assure Satisfactory Performance**



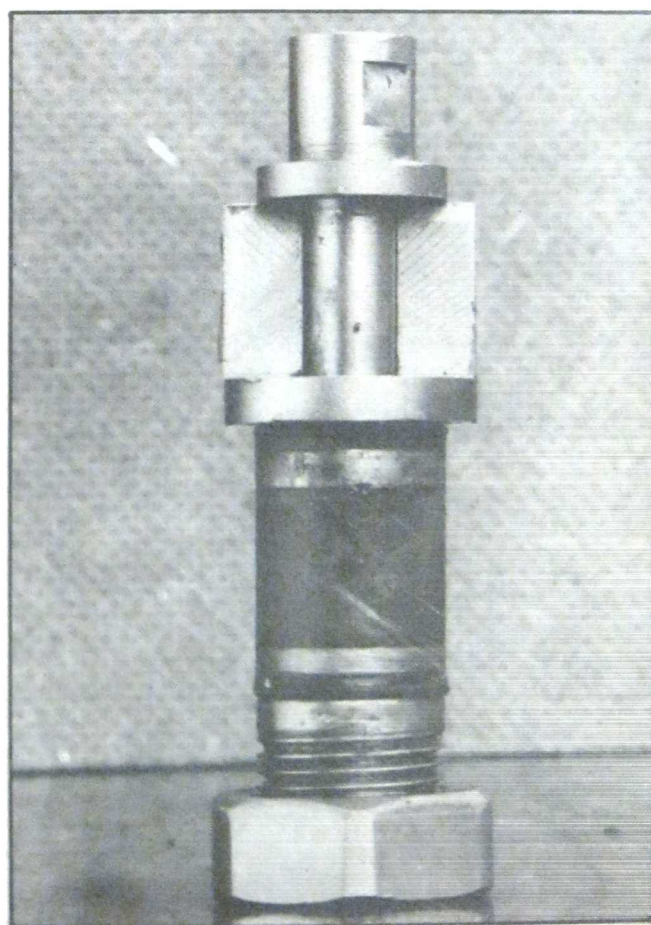
Opposite page and above: My setup for using the Saeco lube/sizer off the portable loading bench. Note the small shelf that C-clamps to provide a space to hold the raw bullets conveniently close to the machine. Cut film boxes make handy containers for packing and storing bullets. (Right) The die for the Pitzer lube/sizer, here in the 9mm (.356") size.

IF A LEAD ALLOY rubs against a steel surface under heavy stress at high speeds, some of the lead will rub off and leave a stubborn deposit of fouling on the steel. In the example of a cast bullet fired in a rifled barrel, this is exceptionally true. Bullets with jackets of the copper alloy called gilding metal, likewise deposit some slight amount of fouling, but it doesn't tend to build upon itself the way lead fouling does.

Lead fouling clings tenaciously and tends to accumulate with subsequent shots, causing any pretense of accuracy to be lost until such time as the bore is scrubbed clean again.

One of the most effective ways to control the problem is to apply some suitable bullet lubricant (lube) in the grease grooves that are provided in most, if not all, moulds for cast bullets.

Since the bullet, typically, emerges from the mould a few thousandths oversize and not quite perfectly round, it needs to be sized to the desired diameter. In most instances, the recommended diameter is .001-inch larger than the groove diameter of the bore. The groove diameter can be



determined by "slugging" the bore. Driving a soft lead projectile into the bore, upsetting it to fill the available space and pushing it back out for measurement with a micrometer.

The measuring technique just described is difficult to apply to barrels of most Smith & Weston handguns since they tend to have five lands and five grooves, equal in width. As a result, a groove portion is always opposite a land portion and, of course, vice versa.

The one-thousandth-over rule is a guideline, not a mandatory law. For example, I routinely size all of my bullets for use in .38 S&W or .357 magnum to .358-inch diameter, even though quite a few of them get fired through my Colt Python, which has a .354-inch groove diameter. They perform well in the P. Horn, but deliver somewhat higher velocities.

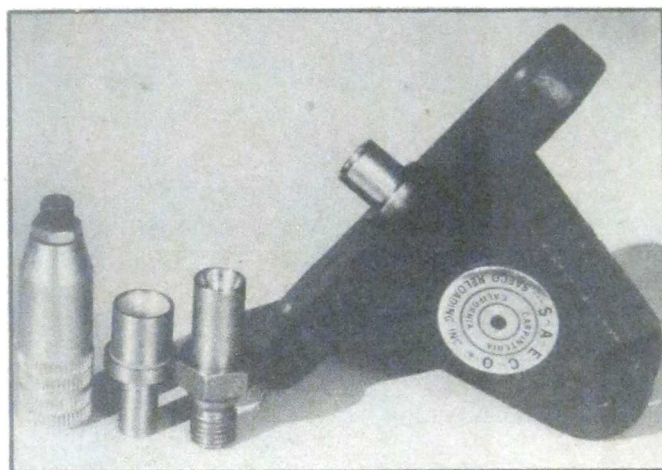
In point of further fact, in the early years of my reloading career, I lubricated all bullets by setting them in a shallow metal tray and pouring melted lube up to the upper edge of the top groove groove. After the lube solidified, I'd use the front end of a fired .35 Remington case to cut each bullet from the pan. I soldered some bent strips of heavy-gauge copper to the sides of the case — from which the head had been cut — to serve as finger-rests and, as I cut bullets from the cake, previous ones would be forced out the top. I didn't size them at all and they shot just fine. In fact, I turned in some groups with that old K-38 that I'd view as quite gratifying today.

When I finally managed to buy a Lyman #45 lubesizer, the predecessor of their present #450, I noted one appreciated benefit: It minimized the excess grease on the

bullet sidewalls and I no longer had problems with lube wiping off the bullet to build up in the seating punch; at least there was much less of a problem than with the primitive system using the modified .35 Remington case. Did the K-38 group better? Yes, it probably did, but not to the instant-miracle extent for which I'd hoped.

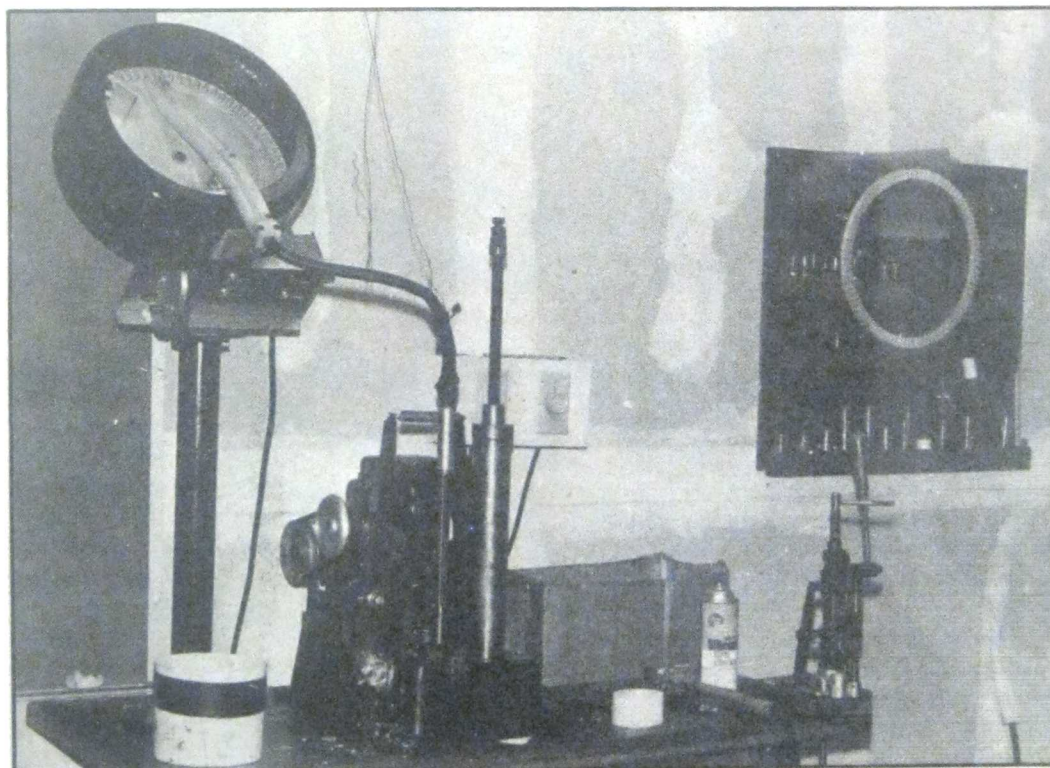
BULLET LUBES

My first bullet lube was homemade, compounded with crossed fingers and some beeswax melted and mixed with Vaseline. If it cooled out too thin, I'd melt it again and add more beeswax, or vice versa. It worked quite well and, of course, being how I am, I had to commence experimenting with various potential miracle additives.



This is an adapter recently developed by Saeco to permit use of top punches from other makers such as RCBS or Lyman in the Saeco machine.

A high-volume automatic lube/sizer by Star, with auto feed and all the trimmings.



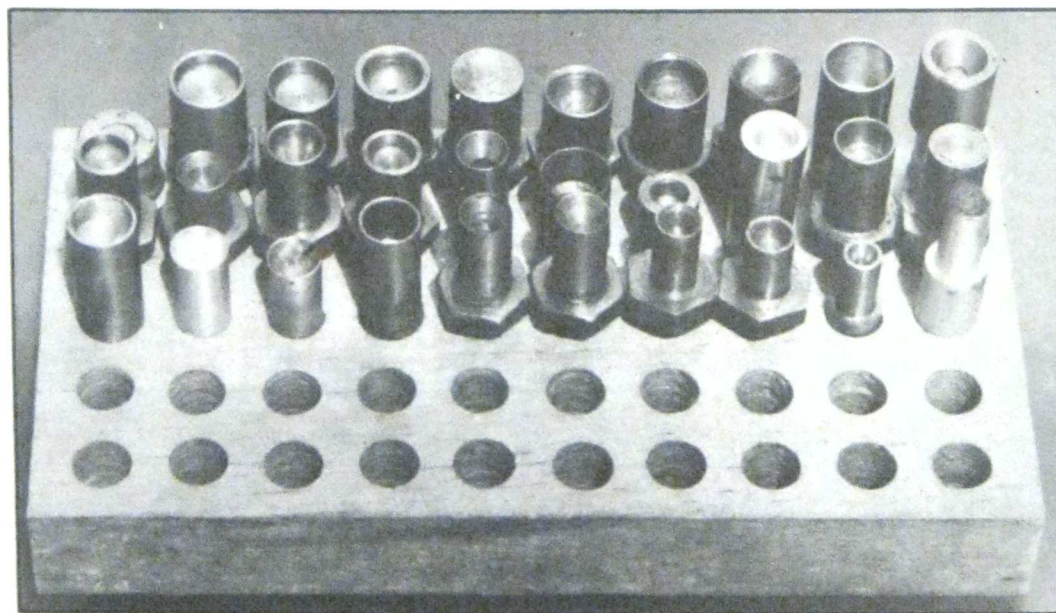
I tried stirring in some microfine powdered graphite and it didn't seem to hurt anything. Actually, graphite is a mild abrasive and I'd not recommend it for ongoing use except perhaps in colloidal suspension.

I tried finely granulated molybdenum disulfide (MoS_2), about the texture of talcum powder and that also didn't seem to hurt anything and perhaps even helped a little.

Then I got the idea of blending in quantities of gun oil, which seemed logical at the time, but, as I was to learn, it posed certain severe drawbacks. I sold a box of .38 Special loads from that batch to a small-town police department and they let the box sit atop a steam radiator all winter, bullets uppermost. In the spring, some local taxpayer came around with a dog he wanted shot and one of the officers took it to the dump, packing along the box of bullets as an afterthought.

During the long hot storage, some portion of the oil had separated from the lube and oozed down to deactivate most of the powder. I quote from *ABC/R-1*, page 154: "The first round refused to fire at all. The second made a diffident pop and the bullet came out with just enough speed

A homemade top punch for handling a .251 round nose for .25 ACP in the Saeco. A small disc of felt is glued in the end and thereby avoids deforming the bullet noses.



My collection of factory and homemade punches for use in the Saeco unit.

to hit the dog's nose smartly and bounce off. Whereupon, the dog flinched rearward, pulled free of his collar and took off. The officer pursued on foot, firing occasional factory loads, for a long distance, finally losing sight of his quarry and having to make a long walk back to his patrol unit. As you may imagine, I heard some remarkably caustic comments on the quality and reliability of my reloads, the next time we encountered each other."

Actually, most bullet lubes would have melted at the temperatures to which those loads were exposed over a long duration, but the gun oil additive only made it worse. If you leave a tray of lube/sized bullets in the pitiless radiance of a hot summer sun, the lube is quite apt to melt out of the grooves and run down the sides, as many have learned the hard way.

Beeswax remains a key ingredient of most lubes and the more expensive refined white version seems to have no great virtue over the golden brown raw beeswax for the purpose under discussion.

There are a great many shooter/reloaders who set great store by lubes compounded from beeswax and another grease known as Alox. Some years ago, the National Rifle Association (NRA) tested the Alox bullet lube and bestowed their prestigious blessings upon it. With that in mind, its popularity is hardly surprising.

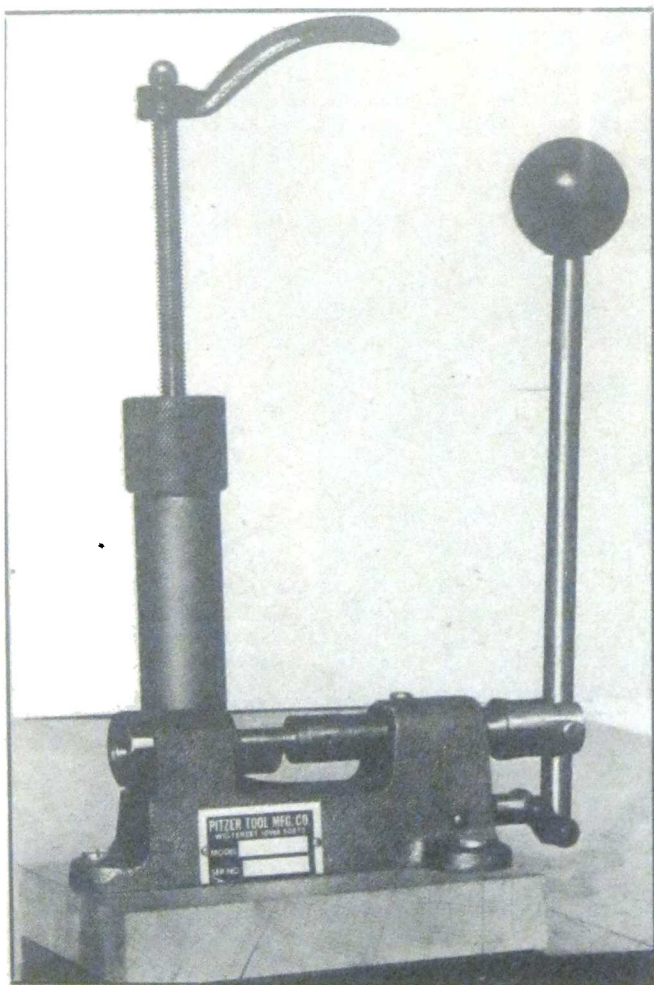
I've used a lot of Alox-type lubes, as supplied by various makers, always with good results. If you leave it in the hot sun, it will melt and run out of the grooves, but so will most bullet lubes. Alox-type lubes prevent or minimize bore fouling up to some reasonably zippy velocities, particularly when a gas check is used on those bullets designed to accept them.

Some years ago, I encountered the bullet lube I like the best of any I've found so far. It was developed and used to be made and sold by Garth Choate, of Bald Knob, Arkansas. Within recent times, I ordered a fresh supply and got back a form letter from Choate, saying they had stopped making the stuff.

It was brewed up, said the letter, in their catfish cooker and they had finally gotten just plain fat-sick and tired of eating catfish with a detectable aftertaste of bullet lube.



Left: Using a homemade punch to seat 30 gas checks in the drill press. (Right) Corbin dip lube prevents leading to moderate speeds



The Choate lube had been made from a lithium-base grease, combined with good old beeswax to specified proportions. It is not an operation the casual amateur should attempt because the melting point of the lithium grease is incredibly high and mixing it with beeswax approaches the flash-point of the latter material. The dangers involved in making it are obvious, or should be.

At the time of writing this, Walt Stephenson, of S&S Precision Bullets (22965 La Cadena, Laguna Hills, CA 92653) is producing the lithium-base bullet lube to Choate's original formula. He started out selling it in dozen-stick lots for a buck a stick, solid or hollow sticks, postpaid to addresses within the contiguous forty-eight states and sales tax should be added on orders sent to California addresses. The price is subject to change, of course.

I've used the S&S version of Choate's lithium bullet lube with the same highly satisfactory results as obtained with the original. It works just fine and the price isn't bad. In comparison, a few years back, I ran out of lube on a weekend session, hopped astride the faithful old Honda CB550 and buzzed down the freeway to a gun store I'd spotted when driving past. Sure they had bullet lube. Here's a stick, right here. It was the Alox kind and I'd've been happy to make do with that, but I got a look at the price tag and blanched to the hue of a flounder's underside: \$2.60! I mumbled my apologies, picked up a hunk of beeswax from a hardware store on the way home, found part of a jar of Vaseline (petroleum jelly) on the shelf and made enough of my own to bridge the emergency.

In warm weather, the lithium lube gets soft enough to fill the grease grooves quite nicely, but I've never known it to melt and run down the sides, even if exposed to blazing Southern California sunlight for extensive intervals. More. I've driven plain-base bullets, cast of hard alloys, to impressive velocities without obvious problems from bore fouling, as evidenced by ongoing groups that stayed nice and clannish. I don't mean to seem to bad-mouth Alox lubes because they work quite well. It's only that, for me, the lithium stuff works even better so I use it, practically all of the time.

LUBE/SIZERS

At the lower end of the price scale, Lee Precision offers lube pans, sticks of lube, lube cutters, and sizing chambers with matching punches. Initially, bullets are placed in the pan, base down, and melted lube is poured around them, up to the upper edge of the top grooves. When the lube solidifies, the bullets are cut free with the cutter of proper size, whereupon they are pushed through the sizing chamber by the sizing punch.

Except for the refinement of the sizing chamber and punch, the approach is quite reminiscent of my procedure, back in the early Fifties and, as noted, I used to get some fine performance out of that method. While prices may change, as of the mid-Eighties, a kit with the tray, cutter of desired size — twenty sizes are available, including five for muzzleloading Minie balls — sizer, punch and a stick of

The Pitzer lube/sizer, as discussed here, saves time by pushing bullets base-first right on through the die, horizontally.

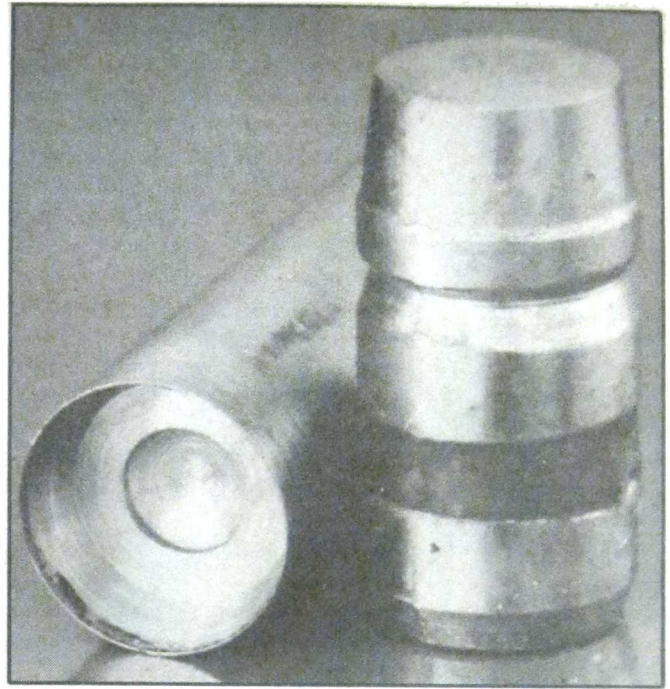
Hodgdon's Alox lube lists for \$10.98 and should be available from your local dealer. If not, write Lee Precision, Inc. (4275 Highway U, Hartford, WI 53027).

Omark/RCBS has a lube/sizer to round out their line of bullet moulds and I'd assume it's a pretty good one. Most, if not all, RCBS gear is good stuff. It's just that I've never used the RCBS unit and cannot speak from firsthand experience.

Star, out of San Diego, makes a lube/sizer that's well up there in price, but warmly regarded by the high-production pros. Unlike most of the other machines, which push the bullet down into the die to size it and pick up the lube, then bring it back up and out to be replaced by the next in line, the Star machine pushes the bullet down and the next one pushes it on through to fall into a receptacle beneath the unit. The potential saving in time and motion should be obvious.

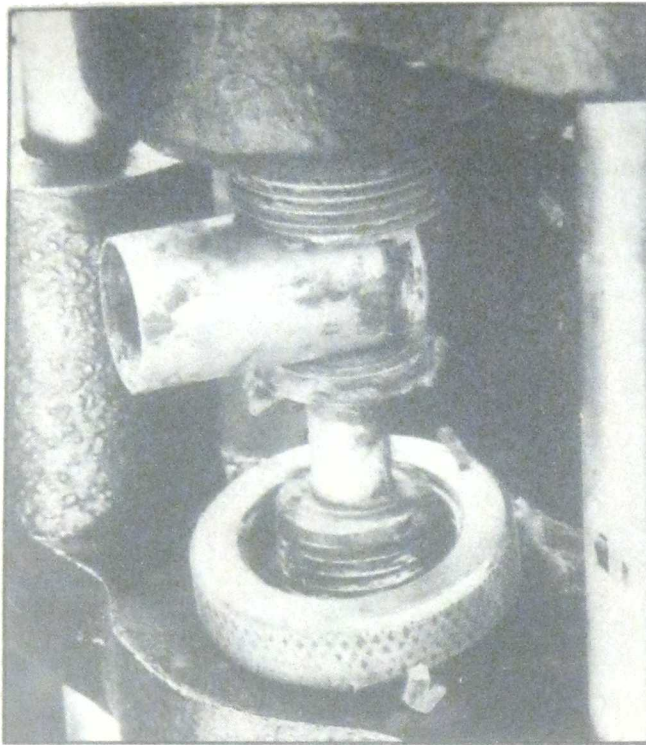
Pitzer Gun Shop (Route 3, Box 50, Winterset, IA 50273) makes the Pitzer Lubricator & Sizer and sells it through dealers or direct, if there is no dealer in the would-be buyer's immediate area. The basic tool, with one die and nose punch, retails for \$140. Additional die sets are \$20, nose punches are \$7.50 — always with the stipulation that prices are subject to change. Like the Star, it's a push-through design, but, unlike the Star which operates vertically, the Pitzer operates horizontally. The die and nose punch is tailored to the given bullet, which must be specified on ordering. If you have more than one style of bullet of a given diameter, you need only purchase another nose punch, provided both bullets have the same number of lube grooves.

Operation of the Pitzer lube/sizer is quite fast and efficient. Bullets as cast are placed on the feed trough, bases

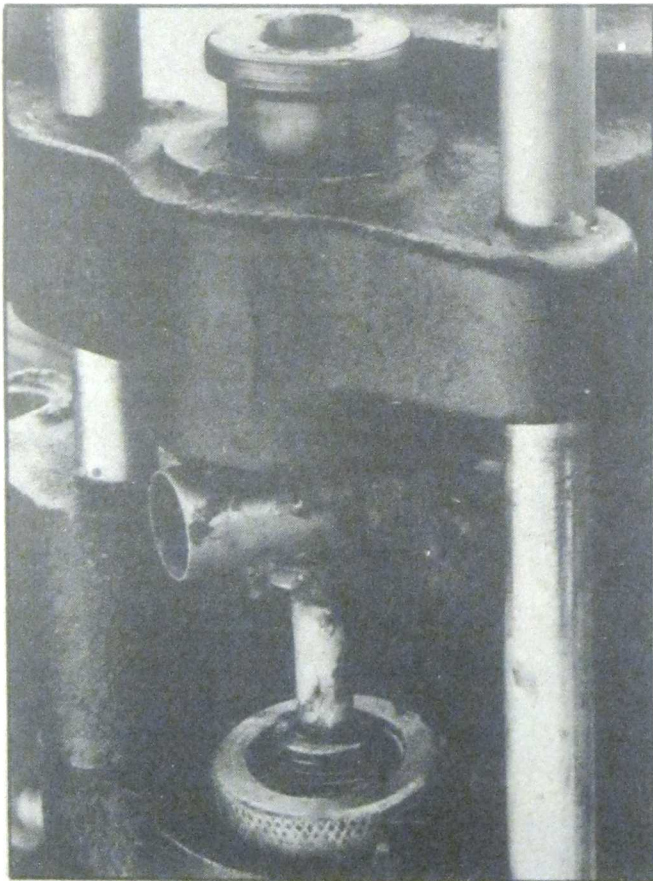


Lube/sizing bevel base bullets, such as the H&G #325, is a problem in the Saeco because lube under pressure makes the bullet pop up out of the die in a thoroughly messy manner. Not a simple solution, but one that works well is to make a contoured bottom punch with its upper end fitted to the base bevel. Such a punch is shown installed in the lower photo, with the H&G #321 bullet for the .357 R-Max.





Look keenly at the bottom photo on page 194. Note an old empty steel #45 ACP case amid the top punches. Here's how it's used to ease and simplify the messy chore of changing the Saeco sizing dies. On its side, it's positioned as above and then the handle is moved upward, raising it as below.



away from the operator and the operating handle is pushed forward to drive the bullet into the sizing chamber and size it. Then the operating handle is drawn rearward, opening the valve to admit lube under pretensioned pressure to fill the grooves. Pushing the next bullet in shoves the previous bullet out and the cycle goes on. Every ten or twenty bullets, depending upon diameter and volume of lube required, you turn the handle down on the reservoir pressure screw to renew the spring-loaded pressure on the lube. It works just fine with the S&S lithium lubes.

As was noted, the current lube/sizer from Lyman is their #450, which took the place of the original #45 quite a few years back there. In use, you lever the bullet down into the sizing die, then reach up and give an educated twitch to the ratcheted handle that turns the piston down to shove grease into the grooves. That is comparable to the RCBS unit, except the latter has an automatic ratchet that gives the piston a little more pressure each time you size a bullet.

At some point within the last several years, Lyman redesigned their sizing dies. Previously, the transition from as-cast bullet diameter to specified sizing diameter was quite abrupt. As a result, any excess of bullet metal was scraped off, rather than being squeezed down and allowed to remain with the bullet proper.

The aforementioned change involved introducing a gently tapering section that sort of swaged the excess on down into the bullet instead of scraping it off. The advantage of the improvement should be obvious.

I used the Lyman lube/sizers, both the #45 and later the #450, exclusively of all others from about 1954 through 1968, with generally decent results, despite the scraped-off metal. It was not a big, insuperable problem.

Then I happened to wander into the West Covina Gun Room and encountered a used Saeco lube/sizer, price-tagged at a moderate \$25. Curiously enough, I had an uncommitted \$25 in my wallet, plus enough more to cover the sales ripoff. I bore it away, mounted it to my bench and came to know warm, faintly gooey contentment that has endured down to the present.

The sizing dies for the Saeco unit incorporated the gently tapering transition portion that gently coaxed the bullet walls down to proper diameter without rubbing any of it off. Processed bullets came out of it so sleekly smooth they appeared to have been chrome-plated. Going on to put them into load-ready cases atop suitable charges of powder, they shot remarkably well.

As mentioned earlier, like the Boston ladies and their hats, from that time down to the present, I've *had* my lube/sizer. From my viewpoint, at least, it has been a highly satisfactory relationship. I have lovingly accumulated dies and bottom punches for nearly all the diameters to which I might wish to reduce cast bullets. I have acquired top punches to fit a great many bullet tips and sizes and, since joining forces with the Corbin/Jet metal lathe in late 1980, I've derived a lot of deep-down pleasure from making up top punches for several other bullets that came along.

The thread at the top of the Saeco punches is 5/16-24, making it a fairly simple matter to do it up with the aid of a die — thread-cutting die in this instance — of that persuasion. As for contouring the lower end of the punch, there are a number of approaches available.

Take, for example, the semi-wadcutter bullet designs. Use a micrometer or caliper to determine the diameter of the nose ahead of the shoulder. Select a drill bit a few thousandths larger in diameter. Turn the diameter of the punch down to a few thousandths smaller than gross bullet diameter. Then drill a hole to appropriate depth, just a few thousandths bigger than the nose portion and there you go. The rim of the punch acts against the wadcutting shoulder and shoves it down into the die and back up in pluperfect alignment: Glorious!

You can accommodate quite a few other shapes of bullet noses by merely running the suitable size of countersink into the business end of the top punch. This results in a sixty-degree cone, with the end of the cavity relieved, and it serves to center the upper end of the bullet quite nicely during the sizing operation.

The late Bob Modissette, one-time owner/operator of Saeco, once mentioned that he'd been looking into an approach for creating custom top punches that would fit any bullet nose whatsoever to utter perfection. It involved a punch blank of the suitable diameter, with a hollow opening similar to the one described for use with semi-wadcutter bullets. You applied a bit of release agent to the bullet tip, gooped some freshly mixed epoxy into the punch cavity and held the bullet tip in the cavity while the epoxy set up. It had the sound of a pretty good idea and I pass it along for what it may seem to be worth.

I've never tried that one, myself, perhaps out of concern that I might end up with the faithful \$25 lube/sizer hopelessly epoxied together and not much chance of finding a replacement at the same remarkably friendly price.

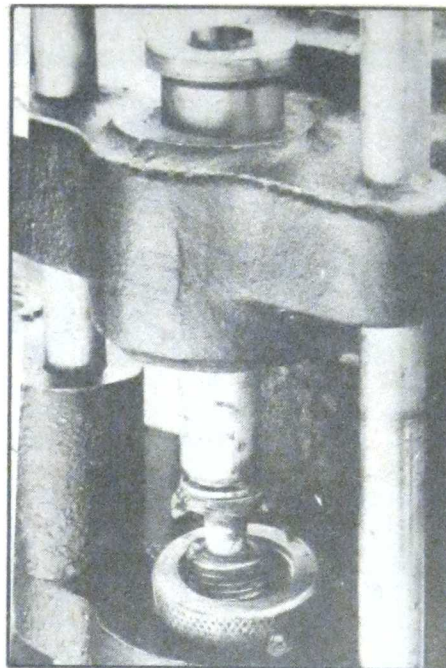
I have, however, tried various other approaches, usually with entirely acceptable success. For examples, you can wad up a small piece of plastic Saran Wrap and stuff it up into the hollow lower end of the nose punch. It conforms to the bullet tip and forces it down into the sizing die without detectable distortion of the nose, which is after all, the object of the game. Light aluminum foil seems to work about as well, or a few disks of thick felt. A judicious amount of aliphatic resin glue — Titebond, Wilhold or Elmer's Professional — applied to the Saran, foil or felt, may prove helpful in holding it all in the desired configuration, once it sets up. Unlike the epoxy, it's not apt to weld the working parts to each other.

GAS CHECKS

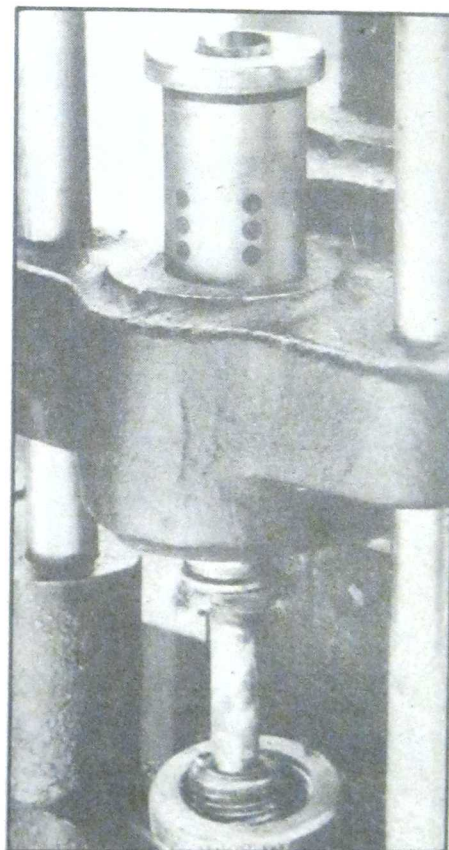
Several cast bullet designs incorporate a smaller step at the base designed to accept a shallow cup of gilding metal termed a *gas check*. The purpose of this accessory is to protect the bullet base from hot powder gas during its passage up the bore and perhaps to aid in scraping off some amount of deposited lead fouling in the process.

At the same time, application of a gas check serves to leave the bullets with bases that tend to be more uniform than the average, mill-run production of plain base cast bullets. Uniformity of the bullet bases tends to upgrade the overall accuracy of cast bullet loads or, for that matter, of jacketed loads. Those are the major advantages of using gas checks with cast bullets.

On the other hand, gas checks have come to be rather expensive in latter years, up around two cents apiece or so, and application of them is but one more time-consuming



The next step is to position the .45 case vertically, as here and then...



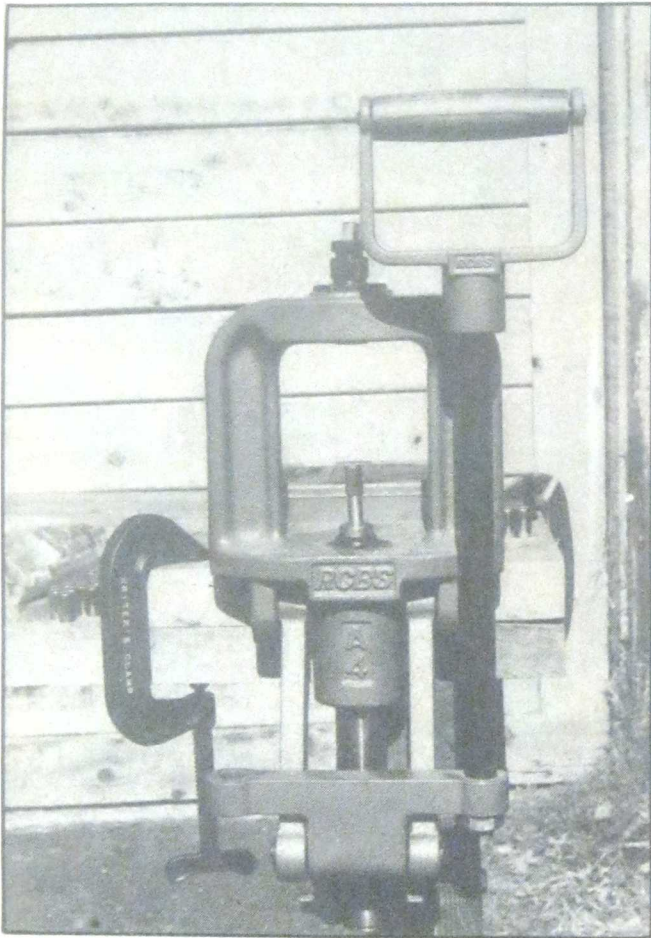
...raise the handle one more time and force the grease-sticky die far enough upward so it can be removed by hand. Simple, no?

step in the lube/sizing operation. It is not unusual to find that plain base bullets perform quite well and, with the better lubes, resist bore fouling up past some fairly giddy velocities.

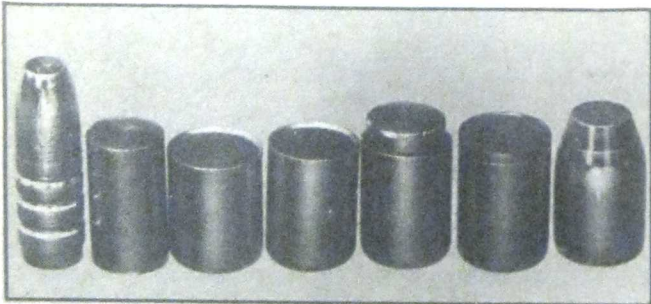
With that considered, it's hard to say that one approach is clearly better than the other. It can be noted, however, that bullets designed for use with gas checks perform quite a bit better if fitted with them. It's possible to use such bullets without gas checks, but I've never found them to work nearly as well.

MAKING SWAGED BULLETS

Instead Of Melting And Pouring,
These Are Squeezed Into Shape!



The usual procedure for making .41 jackets is to draw them down from .44 jackets, using the die from Corbin, a little lube and a loading press.



Steps in making a .41 bullet, using the Lyman #31141 cast bullet as the core and swaging it to uniform weight before seating in drawn jacket.

AS AN alternative to casting, it is possible to produce bullets by cold-forming under suitably high pressure; a process known as *swaging* and pronounced as "SWAY-jing."

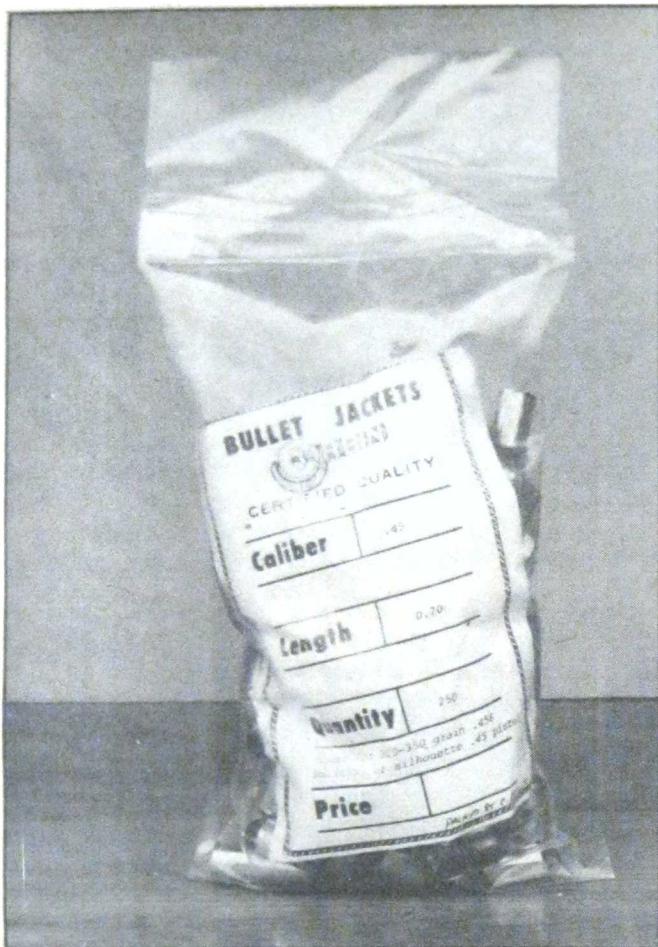
If the resulting bullets are of unprotected lead or lead alloy, their use will result in the same problems as encountered with unprotected cast bullets; no more, but surely no less.

There was a notable vogue, in the early Sixties, to produce bullets by this method, starting about the time the late Charles Heckman introduced the C-H Swag-O-Matic bullet press. It was nominally designed for use with *half-jackets*; which were cups of gilding metal at the nominal diameter and about one-quarter-inch in length. Pure, dead-soft lead was used for the bullet cores and there was no provision to taper the bullet walls. As a result, some amount of soft lead was exposed ahead of the jacket to rub against the bore during firing. Therein lay the problem that prevented any widespread popular acceptance of the operation.

The Swag-O-Matic press and its accompanying dies were fairly inexpensive and quite simple to use. By changing top punches, it was possible to produce bullets in a variety of shapes including semi-wadcutter, round nose, hollow point or a novel design with a hemispherical cavity, of near-bullet-diameter, that Heckman termed the cup point. The last had a capability for expansion that was really awesome. Speer marketed half-jackets in calibers .30, .38, .44 and .45 and Hodgdon produced some .38 half-jackets made of a tough and durable plastic. All these are now off the market, many years since, although Corbin can still furnish half-jackets in the commoner sizes.

Today, there are dip-and-dry bullet lubes — Corbin offers one of the better ones — capable of preventing bore-fouling at moderate velocities and if those had been available in the early Sixties, the swaging concept might have taken root and enjoyed sturdy growth. They weren't, so it didn't.

At about the same time, the Harvey Pro-Tex-Bore bullets appeared. They incorporated a small zinc washer at the bullet base, of full bullet diameter, designed to scrape



A bag of jackets from Corbin, labeled as to the caliber, length and quantity. This has 250.

off any deposited lead in passage up the bore and, at the same time, to deposit a thin coating of zinc to discourage further bore fouling. Initially, they were cast in moulds and the operation involved placing the zinc washer daintily into its little slot in the mould cavity before pouring the melted alloy into place. As you may assume, it posed some

amount of delay, taxed both patience and manual dexterity and resulted in occasional burned fingertips.

On the 27th of August 1961, Charles Heckman, his wife and their three children were killed in a tragic automobile accident on U.S. 80, about eighteen miles west of Yuma, Arizona. Heckman's father endeavored to operate the business for a time, then sold it to various other owners through whose hands it passed before coming to its present seat of activity in Owen, Wisconsin, under the capable guidance of A.F. "Tony" Sailer.

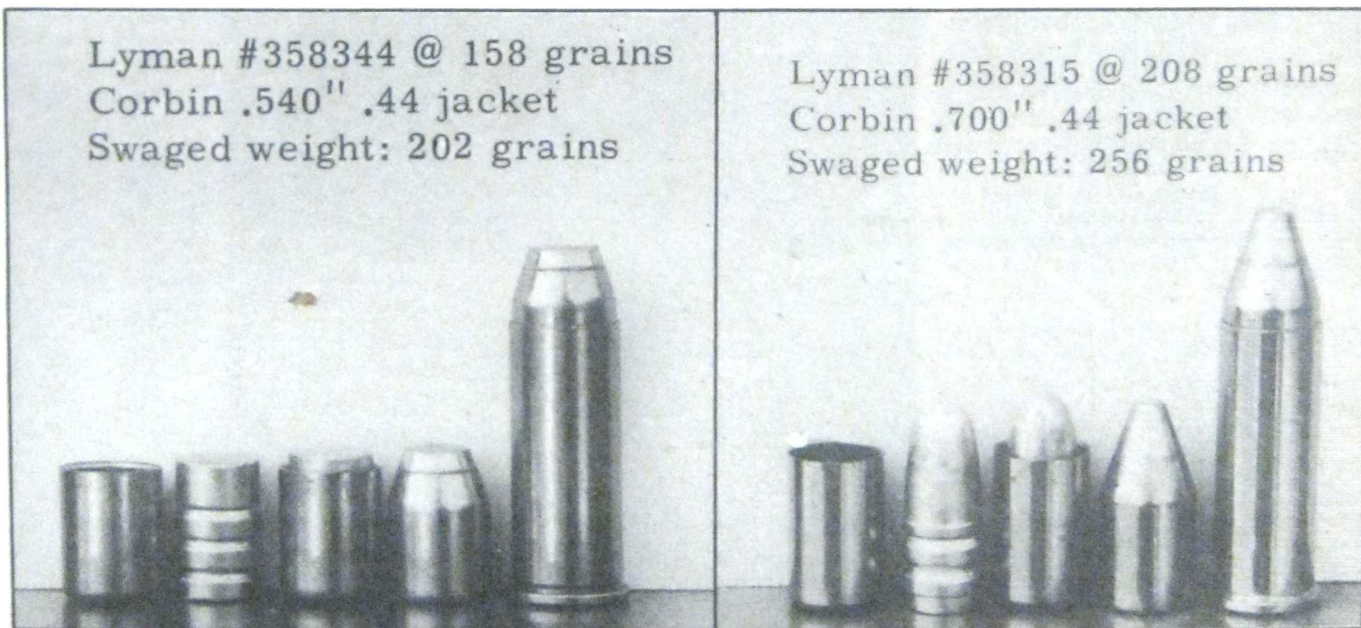
It can be speculated that, had Heckman been spared his untimely fate, there's a good chance that he could and would have eradicated the bugs that plagued the Swag-O-Matic approach because he had a highly original and brilliantly innovative turn of mind. It was not until the C-H operation wended its way under Sailer's wing that any further developments were made in the system.

The first consisted of sets of bullet swaging dies designed for use in heavy-duty reloading presses such as the C-H Heavyweight CHampion. These used the longer bullet jackets and dies that turned the noses in to less than full bullet diameter. That served to prevent contact between unprotected lead and the bore and resulted in a true jacketed bullet capable of being driven to velocities of 3000 feet per second (fps) or more without fouling problems.

At a later point, Sailer developed and introduced the C-H Z-dies, harking back to Harvey's original concept with the zinc washer at the base. Instead of being moulded, the Z-dies swaged the bullet integral to the washer and retained it by means of a rivetlike extrusion going through the central hole.

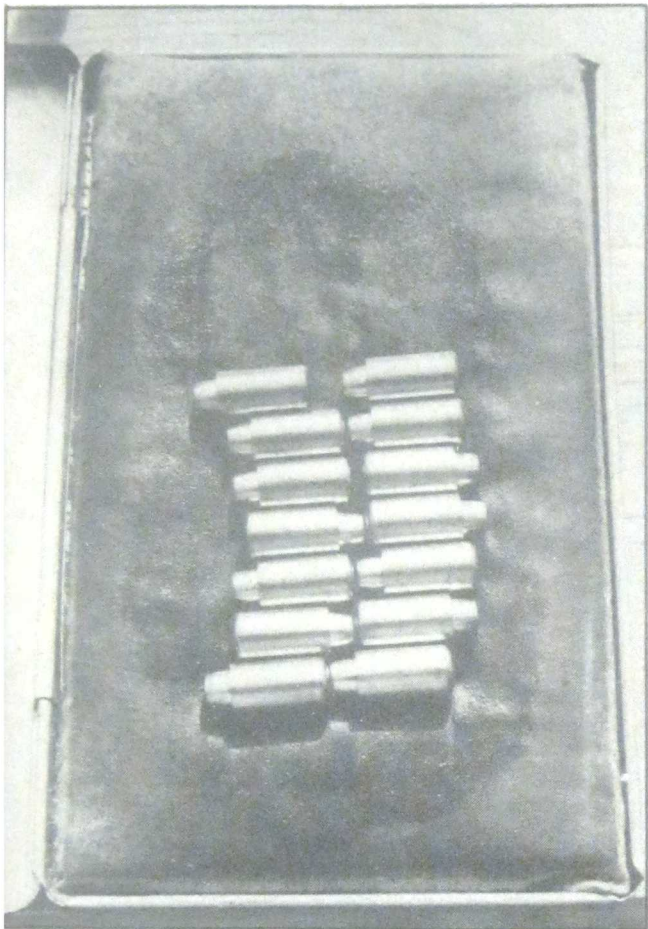
Available in .38 and .44 sizes, the Z-dies and zinc washers remain in the C-H line to the present, as do the swaging dies for production of the three-quarter-length bullets in JHP or JSP designs. Any of the three approaches leave the completed bullet up in the die after initial forming, requiring that it be tapped back out by striking the upper plunger with a mallet. A lever-actuated accessory to

Two examples of .44 bullets, using cast bullets as the core without anything more than a simple pass up into the nose-forming die to swage.

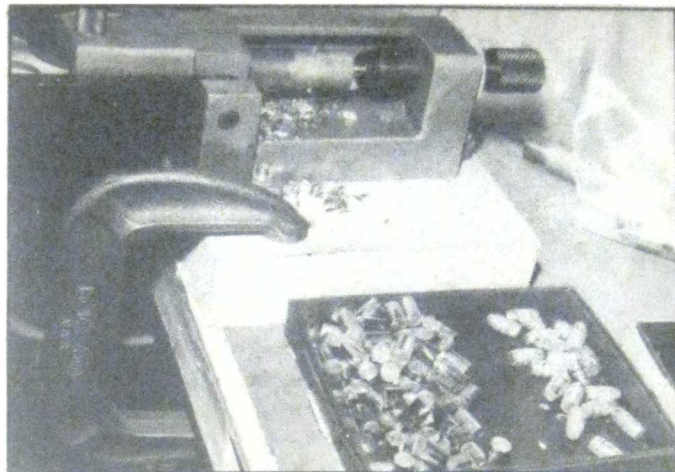


eject the bullet has been designed and may still be available, but it does not offer quite the same level of reliable convenience as did the original Swag-O-Matic, which brought the formed bullet back up out of the die on the downstroke of the press handle.

Bullet swaging dies for production of high-precision rifle bullets have been available, enjoying limited use, for many years. Most such are neither cheap nor are they simple to



Above: Applying Corbin Swaging Lube to jackets and cores before going on to the nose-forming, aids swaging and ejection. (Right) Drawing .44 jackets down to .400 (10mm) size on the Corbin CSP-1 press. Drawn jackets are being neatly caught in a custom-ported milk carton.

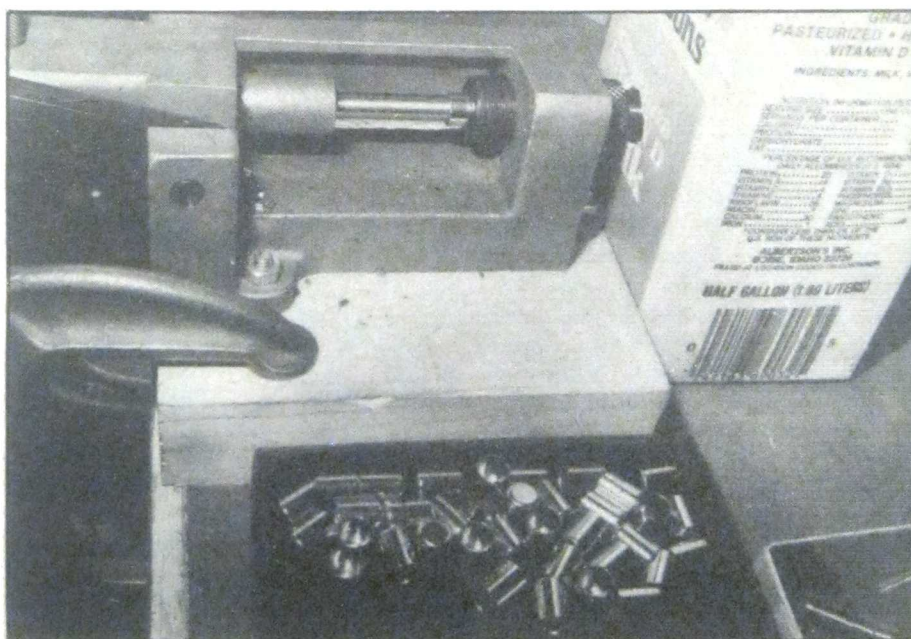


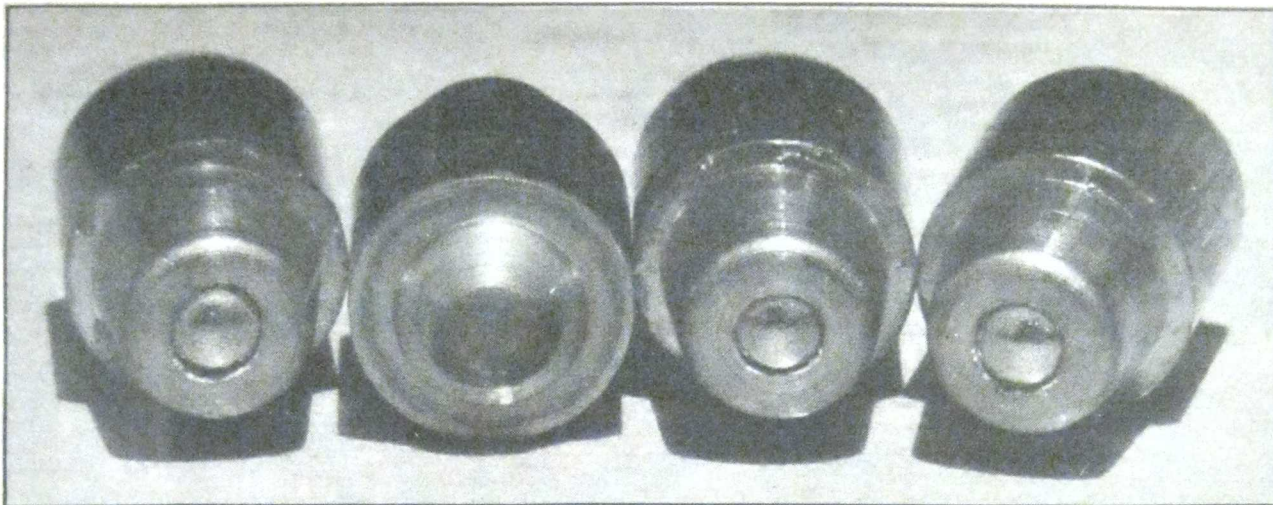
Using the core-swaging die to form cast bullets into uniform size and weight. Note the extruded bits of lead wire that are a by-product of step.

employ at maximum efficiency and that has prevented their widespread use and acceptance. Bullet swaging dies, as a general rule, do not lend themselves readily to mass-production approaches, requiring a considerable amount of hand fitting and finishing. That has tended to keep the supply a little sparse and the cost at a substantial level.

Apart from the C-H offerings out of Sailer's operation, Corbin Manufacturing & Supply remains just about the only other game in town, so far as home swaging equipment is concerned. Dave Corbin and his brother Richard have devoted a lot of diligent effort to development of bullet swaging equipment and distribution of the necessary supplies such as jackets and lead wire for cores. Dave Corbin has authored, illustrated and published several excellent books on the subject, such as *Discover Swaging* and, more recently — with truly inexorable logic — another titled *Rediscover Swaging*. Either or both of these is recommended as in-depth sources for further information on the topic, delving well beyond the intricacies for which space is available in the book at hand.

The current state of the art in swaging gear, at the home





Using special dies from C-H, bullets can be swaged with a zinc washer at their base. In these samples, a steel BB rides in the nose.



Above: Slightly maverick procedure uses a lube/sized Lyman #358429 as the core for a .44 and it works okay. (Below) With a custom punch, it's possible to create super hollow points, such as these in .44 size. Shazam!



workshop level, is the Corbin CSP-1 press, which makes use of die sets and tooling available from Corbin. The same supplier also offers dies and equipment for use with conventional loading presses of sturdy construction, but the CSP-1 approach offers considerable advantages as to capability and versatility.

Briefly, the procedures for production of swaged bullets on the Corbin CSP-1 can be described as follows. Cores are produced, either by casting or by cutting lead wire of suitable diameter into short sections of appropriate length. Following that, the cores are put through the core-swaging die, adjusted to extrude some amount of surplus lead through bleed-holes in the side of the die.

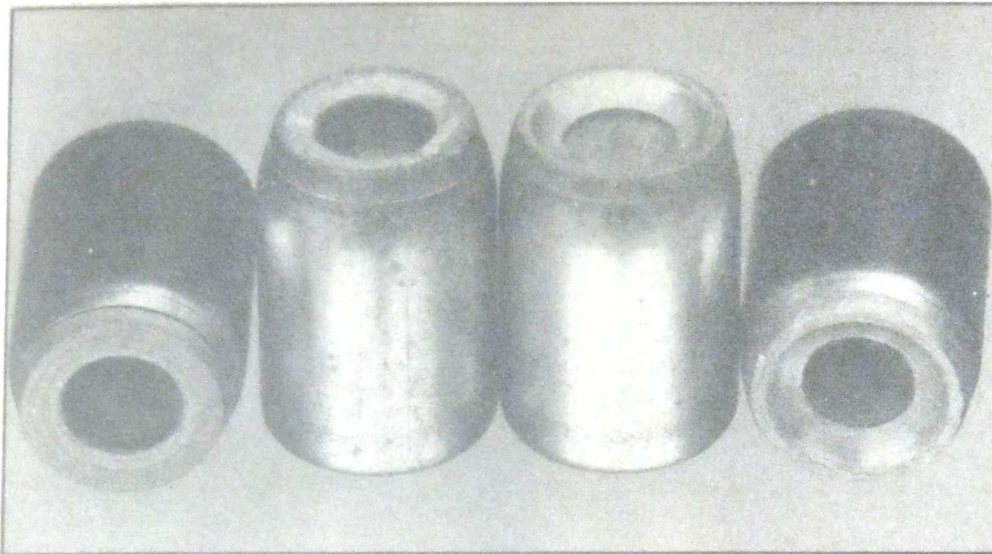
The swaged cores — which now are of a highly precise and uniform size and weight — are placed into jackets and a second set of dies and punches are used to seat the core firmly into the jacket. A further punch/die set is used to form the nose of the bullet to its final shape, leaving a complete bullet, ready to be loaded into a charged case in the same manner a typical jacketed bullets purchased over the counter at a considerably greater cost in cash out of pocket.

Corbin offers adjustable core moulds in various diameters as an alternative for those who wish to avoid the cost of buying lead wire in bulk and cutting it up. For those who already have a few bullet moulds and bullet casting capabilities, I can confide that several cast bullet designs can serve quite well as cores, when cast of soft lead, or even of somewhat harder alloys used for conventional cast bullets.

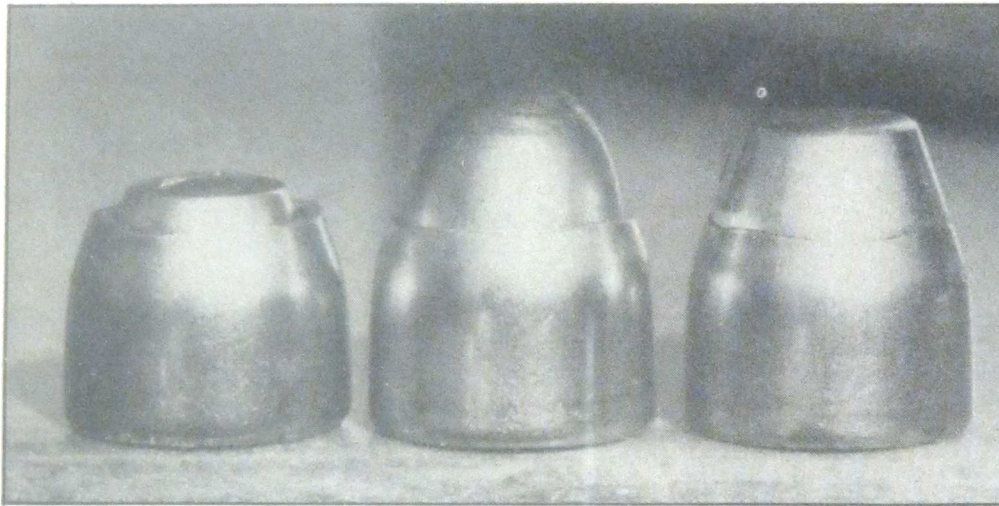
In fact, if you're prepared to make some sacrifice as to utter, all-out, super-tackdriving excellence, there are some attractive shortcuts enabling the production of jacketed swaged bullets at quite a gratifying rate.

Cast bullets for use in caliber .30 usually serve fairly well as cores for production of swaged .38 bullets, provided they are of suitable weight. I have a four-cavity mould for Lyman's #311316 and pure lead castings from that, put into .5-inch jackets, turns out a neat and serviceable .38 swaged bullet at a typical weight of around 136 grains. Data for 140-grain jacketed bullets serves equally well for use with the slightly lighter version.

If you're content to turn out JSP bullets, it is delightfully quick and simple to just drop the caliber .30 casting into the jackets, install and adjust the nose-seating die in the CSP-1



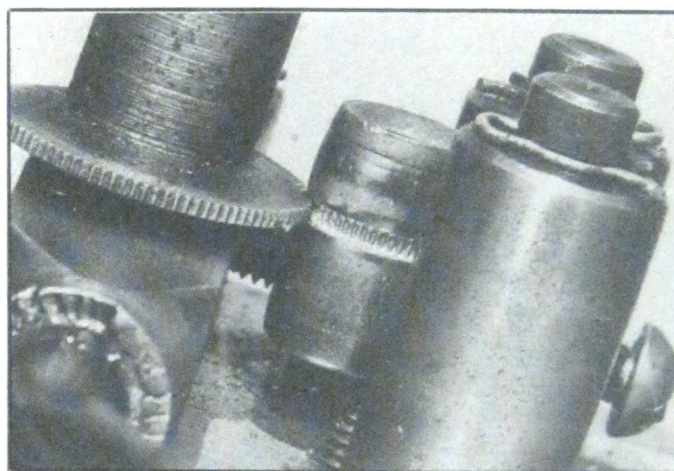
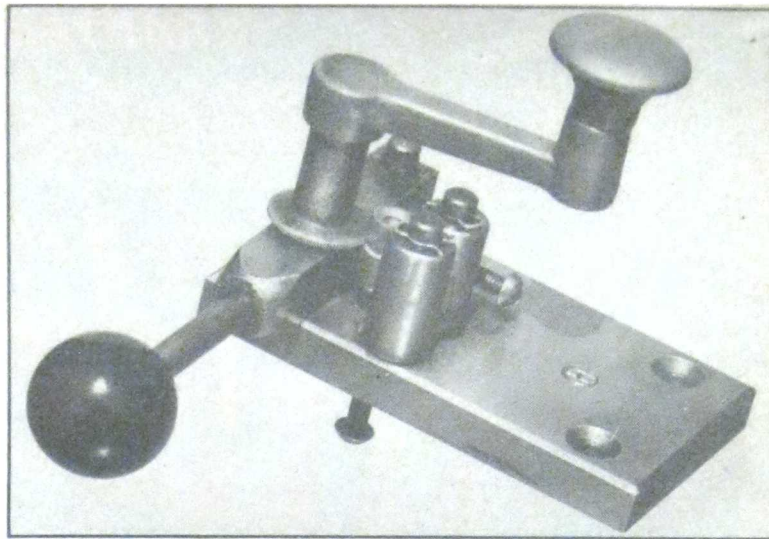
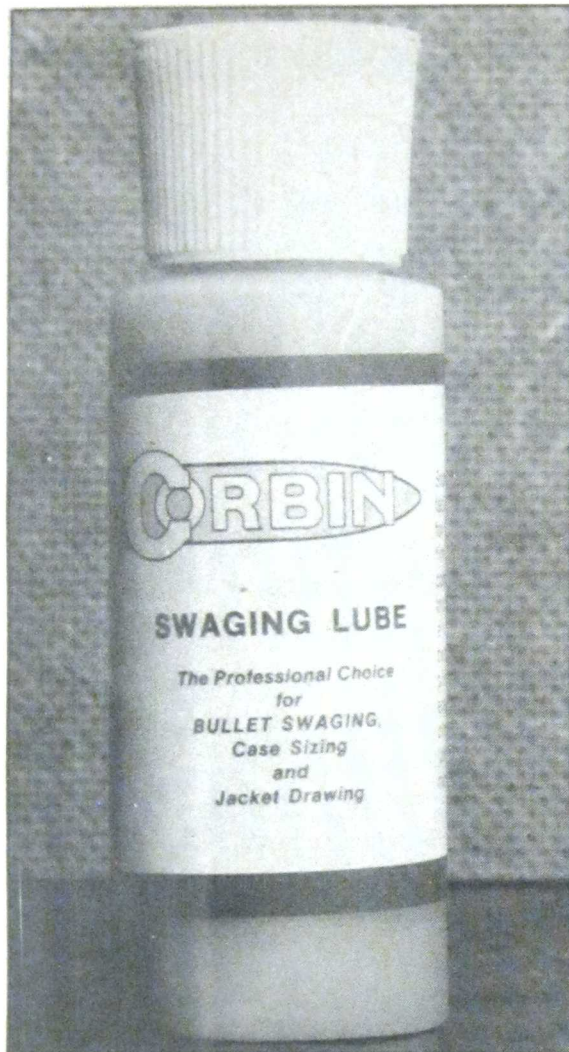
Two formats of what I call the Mourning Glory design in .357 size. Two at right have the periphery slightly dished to improve expansion and appearance.



Three samples of ultra-bleweight bullets for the .41 magnum. As I recall, these got down around 60 to 75 grains or so, but did not perform too well.

Cannelured bullets, at left below, carry a steel BB in the nose. I no longer recall just what utility that was supposed to serve, but merely note it as one of a myriad variants that can be produced via the eminently versatile swaging operation.





Over there at the left is a bottle of Corbin's slickery slickum to ease the strain and effort of swaging steps. Two views of the C-H cannellure tool appear at right. This can be mounted on a bench or held in a bench vise, as the operator may prefer. It's adjustable for position and depth of cannellure if you feel a need for those.

press and roll them forth at the rate of one pass apiece through the press. If you hanker after JHP bullets, use the core-seating die and hollow point punch as a first step and complete them with a pass into the nose-forming die. Either way, it's a quick and easy process.

Naturally, such hasty approaches involve some amount of weight fluctuation. Instead of holding to a uniformity of a tenth-grain or so, the variation is about that of routine cast bullet production; say as much as a full grain or so in either direction. Thus, in this example, they might range from as little as 135 to as much as 137 grains. Since you're loading to recommendations for a 140-grain bullet, there is still a comfortable leeway as far as peak pressures might be concerned, so safety does not pose a problem, so long as you don't load to what friend Hamilton terms the Suicide Maximum. I've often wondered how he came up with that chilling term.

How much is all-out accuracy apt to suffer from so cavalier an approach? Probably considerably less than many would be apt to imagine. Typical group sizes can be expected to vary somewhat, even with lots of bullets that scale the same right down to doodley-zilch, as you vary the kind and quantity of powder in the charge. The random-

factor introduced by variations in bullet weight by one full grain in either direction, when teamed with one of the better powder charges, results in less spread than you get with one of the poorer choices of powder charge.

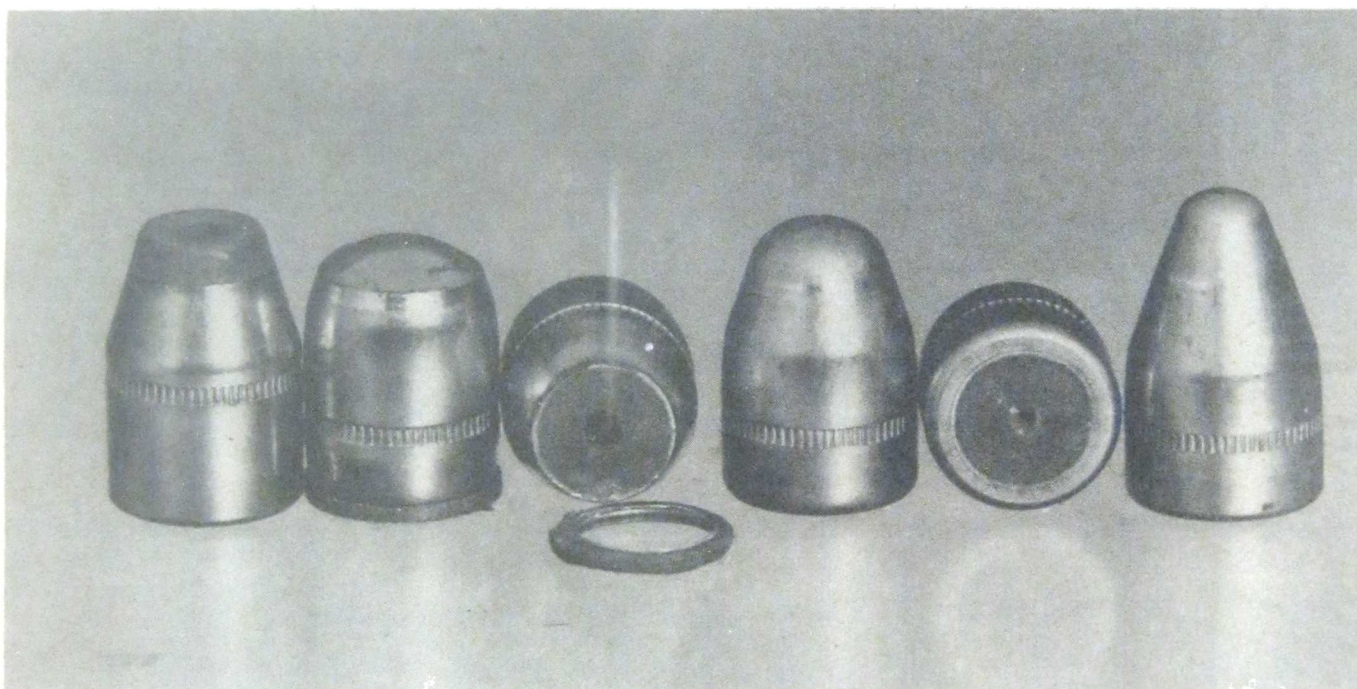
In mentioning all such maverick approaches, I don't wish to seem to encourage a casually carefree attitude toward reloading because, in general, careful attention to precision and fine detail is the way to go. More, I can visualize the pained grimace that is sure to course across Dave Corbin's bearded visage when he reads this and, for that, I duly apologize, hoping he'll also forgive the tongue-in-cheek as I do so.

At the bottom line, splitting hairs into progressively finer strands is okay if it turns you on, but, as some have discovered, it encounters a point of diminishing returns, after about so long.

To perform satisfactorily, swaged bullets require either jackets or grease in the grooves. How to get grease in the grooves? Details on that are in the next chapter. For most jacketed applications, the jackets are not cheap, but for one exception and we'll discuss that in the chapter after the next one.

REMANUFACTURING BULLETS

Factory Bullets Or Cast Bullets, Alike,
Can Be Transformed Into Many New And
Useful Formats, Or Into Other Calibers

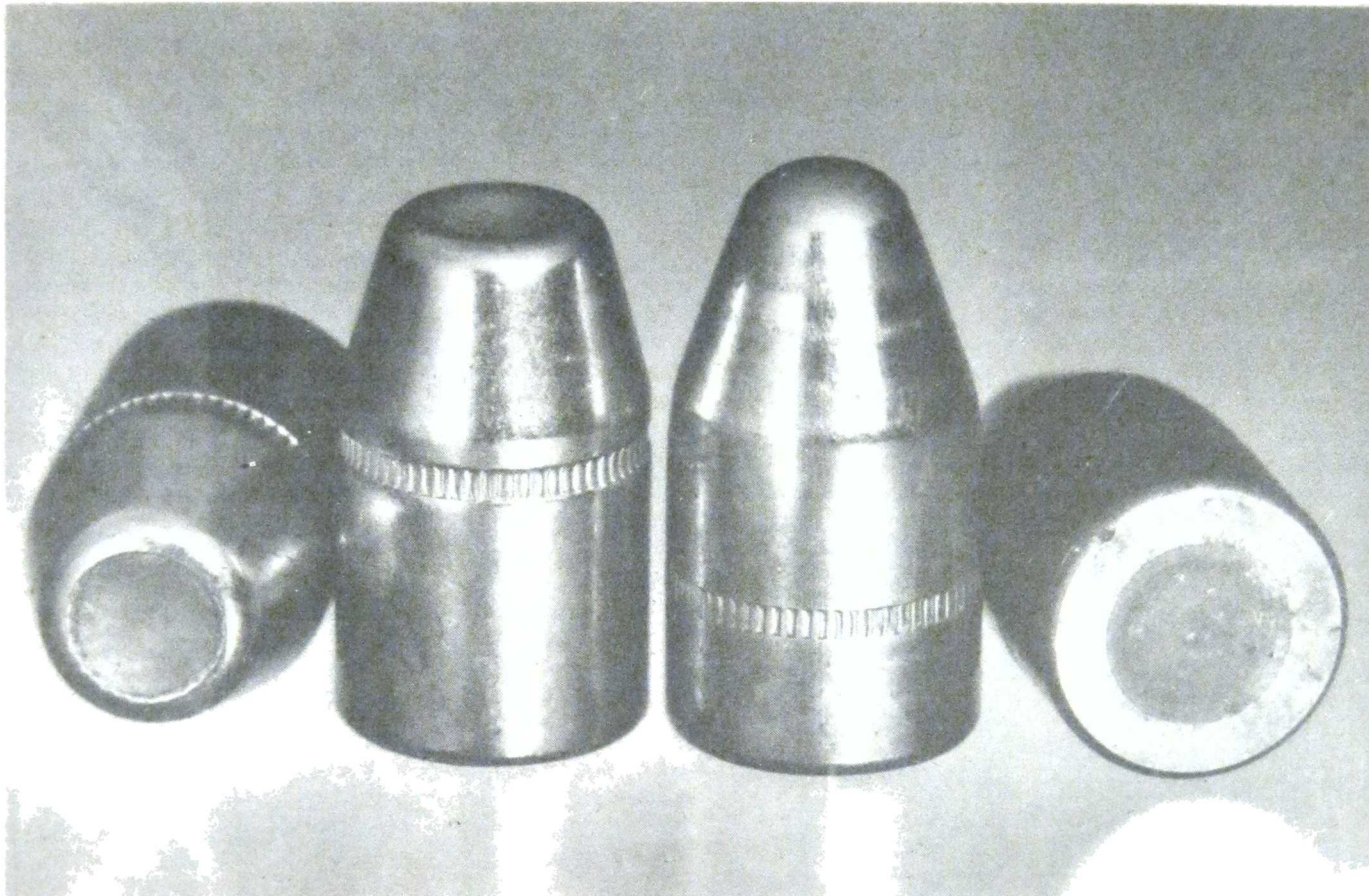


Here's the perfectly admirable little 170-grain JHC Sierra #8500 bullet (left) being transformed into a .41 FMJ (right). It's put into the point-forming die of the Corbin CSP-1 press base-first and lightly stroked. That trims off a ring of excess lead (#2 & 3). Readjusting the die, a further pass gives a blunt point and a nicely turned-in jacket at what is now the base. One more adjustment and pass gives it a sharper point as at right. FMJ bullets are not readily available in .410-inch size, but can be produced by this approach, if desired.

THERE MAY COME a time when it seems desirable to modify the basic configuration of a given bullet, perhaps to transform it to a different diameter, or shape it to other contours within the original diameter. Given the necessary equipment, this is not a particularly difficult operation and the revamped bullets often perform quite well.

One obvious example where such constructive chicanery may be indicated is when producing bullets for the less-

popular calibers such as the .41 magnum and other cartridges requiring a bullet of .410-inch in diameter such as the .41 Avenger or .411 JDJ. There are .44 bullets — typically .430-inch in diameter — available in generous profusion as to design and weight and it may seem attractive to slim some of these down to .410-inch girth for use in the slightly smaller bores. This can be done, quite successfully, but there are a few important considerations involved.



The Sierra #8530, a 220-grain Silhouette design in .41, responds even better to the modification discussed on the facing page, making the transformation without loss of lead. Note the turn-under of the jacket at what is now the base. If you don't have that, the blast of powder gas is apt to peel the jacket like a banana as the bullet leaves the muzzle, resulting in some mystifying, asterisk-shaped () bullet holes in the target.*

Corbin offers a size-down die for use in conventional reloading presses of adequate strength and leverage. It consists of an upper die, threaded the usual 7/8-14, together with a punch that snaps into the press ram in place of the usual shell holder. The upper die holds a constricting ring which — with the aid of a moderate amount of sizing lube — serves to slim-down the larger bullet as the punch, applied to the bullet base, forces it upward. The same basic setup can be used to excellent advantage for reforming .44 jackets into .41 jackets and — with fairly decent success — for bringing cast bullets from .430 down to .410-inch size. The practicability of reworking cast bullets depends upon the properties of the alloy from which they were cast, of course.

You can size a conventional jacketed bullet — either home-swaged or factory-built — from .430 down to .410-inch without a great deal of difficulty, given the Corbin die and punch and a suitably muscular loading press (good news), but if you load it into a cartridge and try it out, it's highly probable it won't group for sour owl-sweat (ba-aad news!).

The problem lies in the fact that the gilding metal jacket is somewhat elastic, and springs back slightly after passage through the die, while the lead core is quite inelastic and doesn't spring back. That leaves the jacket and core considerably short of the intimate contact that helps to coax

them all through the same hole in the paper, the way you probably had in mind.

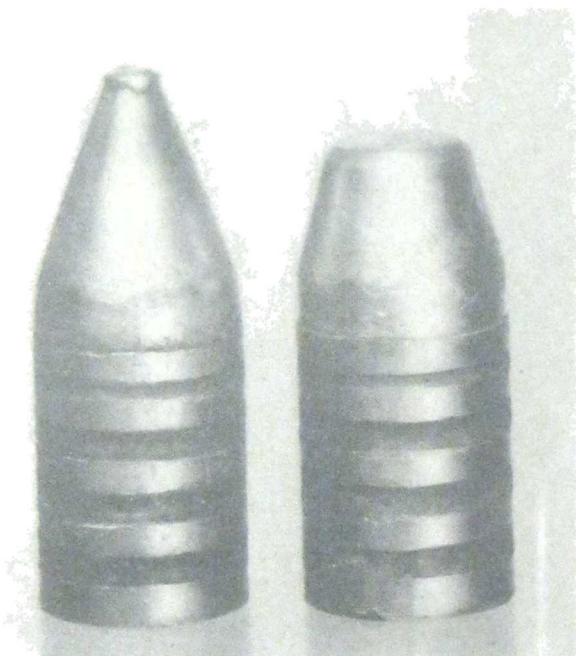
The final step that makes everything come up roses again consists of putting the sized-down bullet into a set of swaging dies for the smaller bullet diameter — .410-inch in the present example — and applying some judicious amount of squeeze to restore the moderate but vital tension of the jacket against the core. Given that necessary attention, it is by no means unusual to find the remanufactured bullets are capable of performance at least as good as in their original format, perhaps even better.

In the example of the .41 Avenger cartridge, which consists of the .45 ACP case necked to accept bullets of .410-inch diameter, you may see a need for bullets of FMJ design. Perhaps you hanker after some of those for use in the .41 magnum, for use in metallic silhouette competition or to secure a greater amount of penetration. No matter the reason, a quick check of available factory bullets will show a decided dearth of FMJ types available in .41 size.

Given swaging dies and a suitable press for making up .41 bullets in the first place, it's a delightfully simple matter to create FMJ bullets in bounteous profusion by a process I term *reverswaging*. Put simply, that consists of applying a wee dab of lube to the given factory bullet, putting it into the swaging die with front to the rear and vice versa, and stroking it through the press after suitable adjustment of the

die and punch. The die, in this instance, is the one customarily employed for nose-forming in the final phase of conventional swaging.

When performed on Sierra's really excellent 170-grain JHC bullet, you will want to do this in two stages. For the first, adjust things so it just barely pinches off the exposed lead at the nose, leaving the excess as a thin ring that can be plucked off and discarded. Process the required number of bullets in that manner and then readjust the punch and die to shove the former bullet base up into the nose-forming end of the die to the desired extent. Perform the second



A heavyweight .41 bullet from a mould by SSK Industries, right, modified to the more pointed contour at left by a pass through the nose-forming die of the .41 set by Corbin.

operation on the run of bullets and there you go.

In doing all that, you'll find that what is now the bullet base has the edge of the jacket neatly turned-in, all around. There will probably be a tiny cavity in the center of the exposed lead at the base; all that remains of the original hollow cavity. Being nicely centered, that has no harmful effect on bullet accuracy.

The turned-in jacket at the base, however, is quite vital to satisfactory performance. If the jacket just comes down straight and ends at the rear edge of the bullet, you are apt to find you've produced a bullet that leaves asterisk-shaped holes in a paper target. That can be quite puzzling until you stop to consider the state of affairs as the bullet leaves the muzzle. In the course of engraving the jacket against the lands and grooves of the bore, it will have been weakened significantly at each juncture between land and groove. As the bullet leaves the muzzle to become airborne, the base is exposed to the really savage blast of released powder gas and the scored jacket walls are quite apt to be peeled away in a manner like unto a great, ripe banana, leaving them jutting from the bullet base in flight, rather like the rotor

blades of a helicopter. If that happens, as it's apt to, the effects are clearly apparent when it gets to the target.

Whether or not such a singular state of affairs is to the good or not can be debated. Properly harnessed, it might be possible that such a bullet could serve in the manner of an archer's broadhead arrow. I doubt if it would be any more effective than an expanding bullet of more conventional design and the effect upon accuracy does not seem overly encouraging. Put another way, I doubt that the reloading world is apt to clasp the Asterisk Bullet to its affectionate bosom. I can, however, confide it's singular experience, the first time you encounter such remarkable holes in the paper.

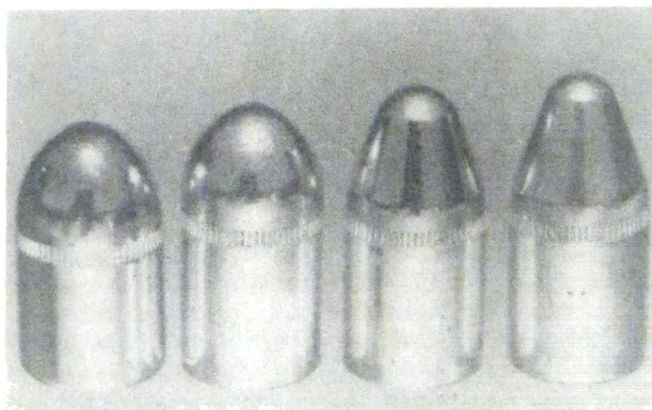
The same general approach works at least as well in reverse. By use of swaging equipment, bullets of smaller diameter can be "bumped" to larger sizes. You can remanufacture 9mm bullets to .357 size for use in revolvers requiring the latter diameter, thus obtaining access to a bewildering profusion of FMJ designs not commonly available for such use. For that matter, you can also modify .41 bullets into .44 or even .45 size. The simple, basic operation makes it possible to produce a great many bullets not available through commercial channels.

REMANUFACTURING CAST BULLETS

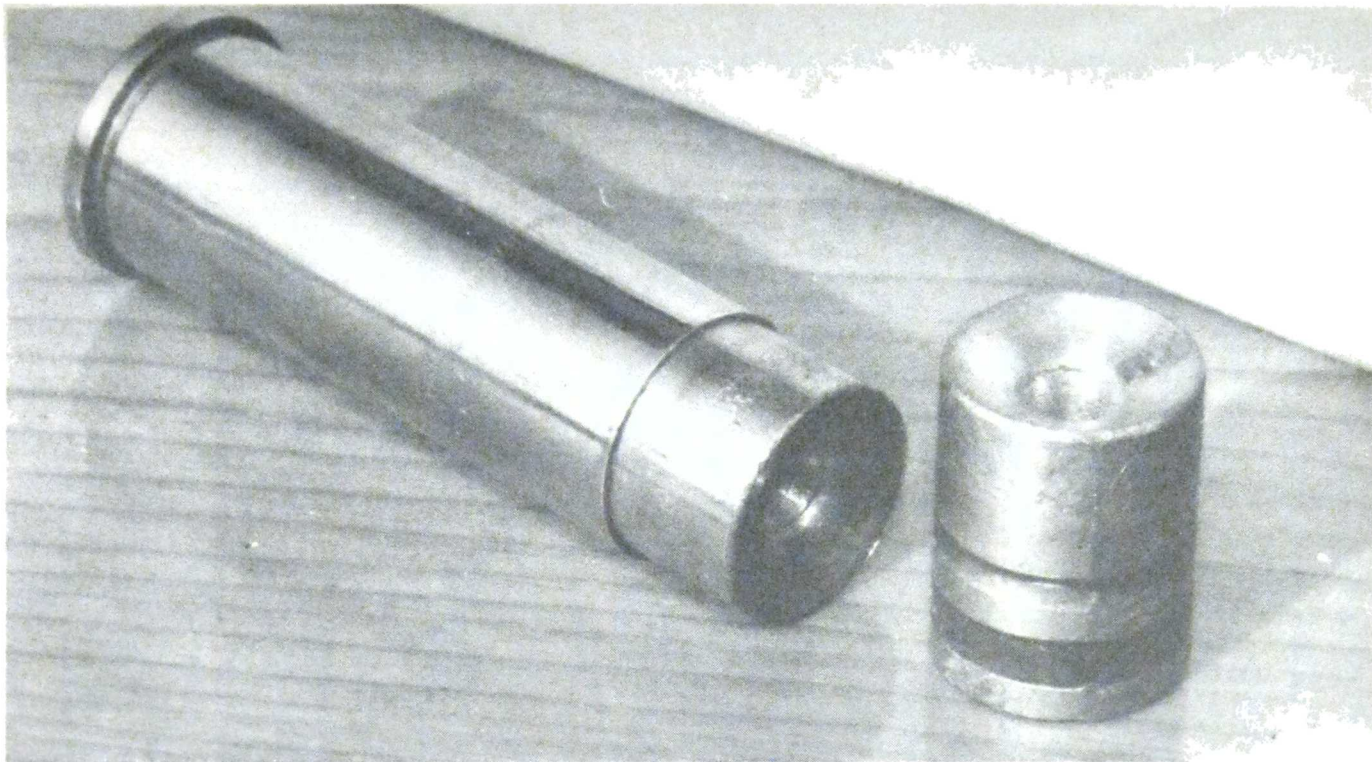
The customary shape of the nose-forming swage dies in sets such as Corbin furnishes is that of the truncated cone: a cone that doesn't quite come to a point. Bullets with a flat or rounded point can be put through such dies to reshape them to blunt-tipped conical designs if that strikes your fancy.

The operative consideration, here, is that bullet lube is an incompressible material and, once it's in place in the grooves, it has no place it can go during any further swaging or modification. Provided the alloy used in the original casting has sufficient ductility, a cast bullet can be modified in shape quite extensively.

One of the more interesting options is production of specialized versions of hollow point bullets from cast and lube/sized bullets that started out with solid noses.



The .44 FMJ at left was pushed through the Corbin size-down die (#2), then progressively swaged in the point-forming dies (#3 & 4). The swaging step is absolutely necessary.



After being cast and lube/sized in the usual manner, this .44 bullet was swaged to its present configuration by means of a homemade punch in the Corbin CSP-1 press. The inner cavity goes down to a point and the perimeter shelves inward. I call this the Spelunker and its expansion is remarkable, even at modest .44 Special velocities. The casting alloy must be soft enough to swage without crumbling. The lubricant remains in place because it's incompressible and has no place it can go. With a bit of research, these are effective.

I've had and been using one of the C-H Swag-O-Matic bullet presses since the late Charles Heckman introduced it in the early Sixties. These have not been produced for a long time, but, presumably, there are others who still have them. The machine is superbly well-adapted for experimental bullet production since it is an elementary exercise in machining to produce all manner of custom nose punches or even bottom punches and dies for use with it.

The original Swag-O-Matic dies incorporated a small bleed-hole in the side, for use in producing the half-jacketed bullets to a uniform weight. When used to remanufacture cast and lube/sized bullets, the bleed-hole becomes a pronounced liability because, even under moderate pressure, some amount of bearing bands and lube is lost through it. As a result, when making up a new die, one omits the bleed-hole and gets around that particular problem. Ideally, the die should be reamed to final inside diameter. In slightly Spartan practice, it doesn't work all that badly to drill the hole to nearly final size and finish it with a conventional drill bit, if one is available in the desired size. A letter T drill bit, for example, is .58-inch and serves reasonably well for production of a die for use in making bullets for use in .38 Specials and the like.

Given access to a metal lathe and even modest skill at its operation, it becomes possible to produce tooling for production of some fairly remarkable bullets. Nearby illustrations show some of the possibilities. For example, 9mm bullets such as from the #377 Saeco mould can be cast of a suitably malleable alloy, lube/sized and then put through the Swag-O-Matic with homemade tooling to produce what I call the Spelunker bullet. The term was selected

because, when the bullet hits, it goes *Spe-Lunk!* and excavates an instant cave.

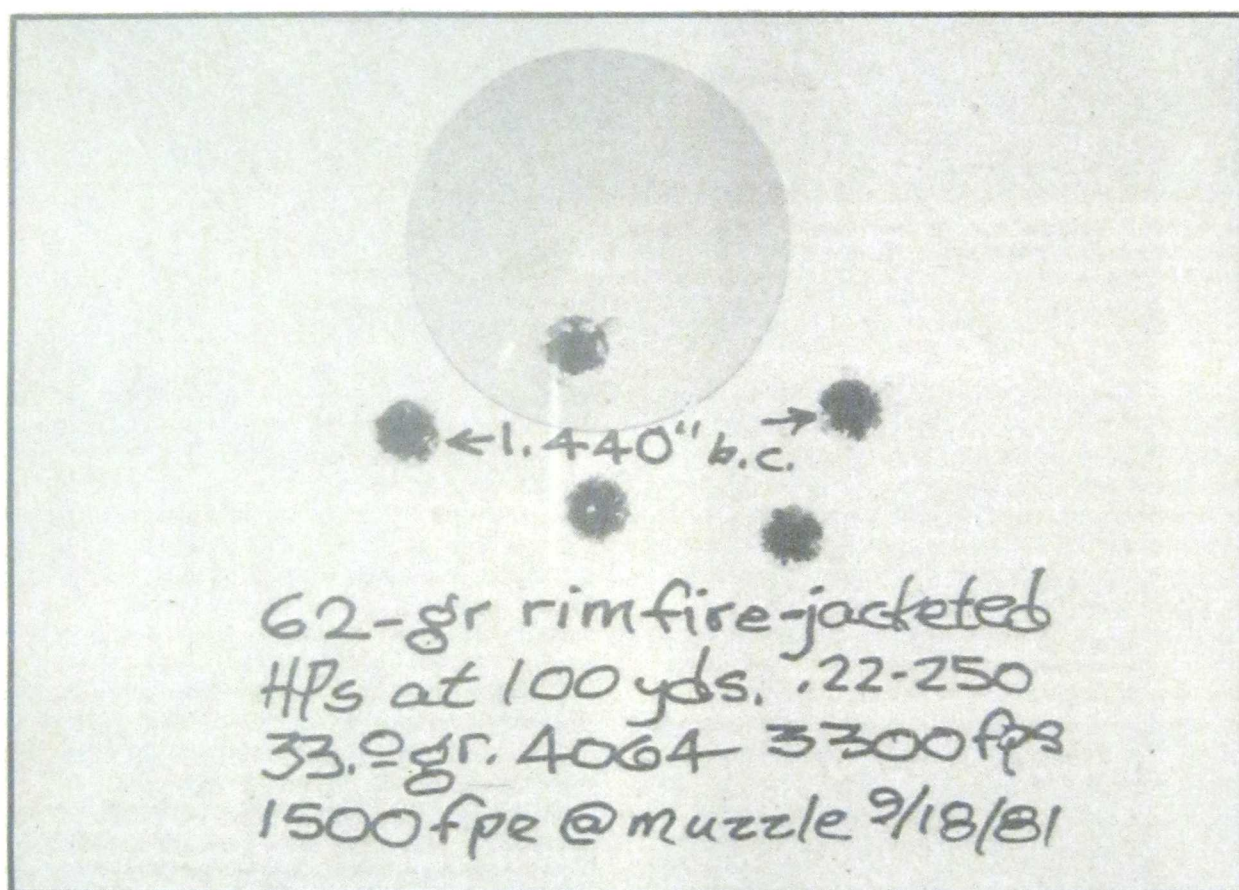
Expansion of this particular design is about as abrupt and decisive as anything is apt to get. In a .38 Special, driven by but 2.7 grains of Bullseye to a velocity of perhaps 600 fps from a S&W Chiefs Special into the claylike material called Ductseal by its manufacturer, typical Spelunker expansion is to about caliber .60 or so. As the velocity increases, expansion follows suit, *con mucho gusto!*

Since the bullet alloy is moderately hard and lube is present in the groove, it gets away from the bore-fouling bugaboo of bullets swaged from soft lead and the usual potential for accuracy is surprisingly good.

Lacking a Swag-O-Matic press, but with access to bullet swaging die sets such as those available from Corbin or C-H, the same 9mm bullets can be cast and lube/sized, then swaged with homemade nose-forming punches into the same general configuration, with the added benefit of coming out at the actual .357-inch diameter instead of a thousandth or so larger. It's merely a matter of forming the punch to taste, drilling and tapping a 10-32 hole in its base and inserting a short section of threaded rod with some Loctite to keep it in place.

I could discuss all this further. Indeed, it requires restraint to keep from doing so, as I regard it with considerable fascination. It's not everyone's cup of tea, however, and those whose fancy it strikes are apt to explore the further ramifications on their own initiative. Any comments or reports on such activities will be welcomed with exceptional interest.

RIMFIRE HULLS FOR BULLET JACKETS



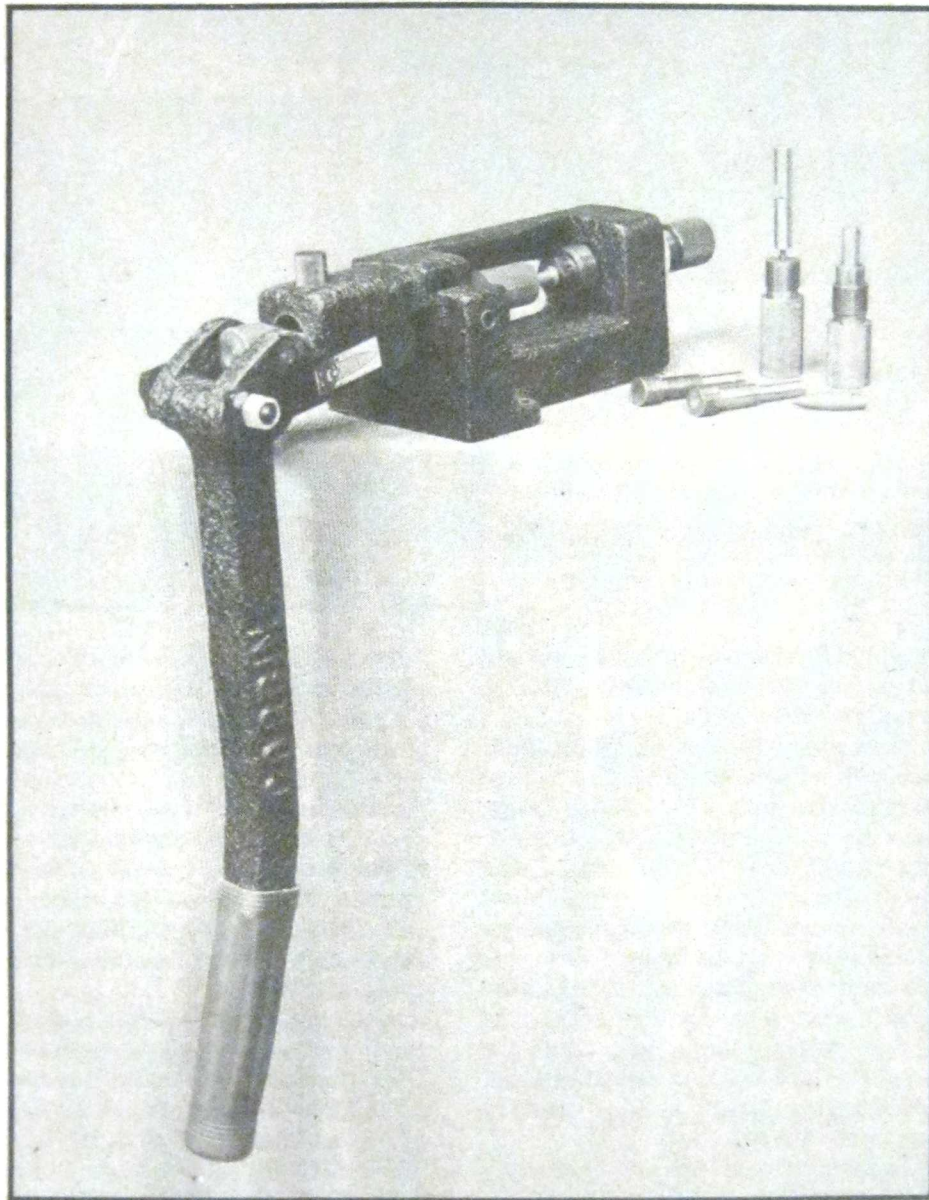
Shown against a 1¼-inch aiming paster, here's a five-shot group with bullets made up from .22 rimfire hulls for the jackets. I'd hoped to clump the holes a little closer, but that particular rifle wasn't being overly cooperative that day, turning in some mediocre groups with factory-bullet reloads and factory ammo, too.

RIMFIRE CARTRIDGES are not practical to reload and that makes their spent hulls items of little or no value. As a result, shooters on public ranges tend to carpet the ground with them, creating a problem when it comes time to pick them up. The person who invents a brass magnet should really clean up...

The tiny hulls have at least one useful application, how-

ever: You can use them as jackets for making up jacketed bullets in .224-inch diameter for reloading the .22 center-fire cartridges. As ideas go, that is not particularly new. They've been doing it since well before WWII; just how long, I really can't say because I don't know. During the great bullet shortage of 1941-46 or so, both Vernon Speer and Joyce W. Hornady made a lot of bullets from .22 rimfire jackets, starting out originally as partners and branch-

Here's A Novel Approach That Makes It Fairly Simple To Produce Jacketed Smallbore Bullets For Costs As Low As A Penny Apiece!



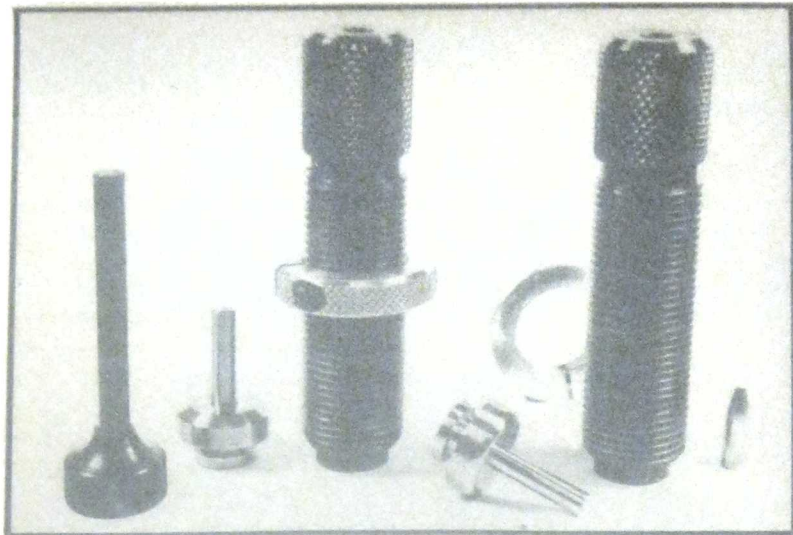
The Corbin Model CSP-1 swaging press is now available in super-strong AMPCO-18 alloy, a bronze containing both iron and aluminum that's stronger than cast iron and wears longer, too. Bullets with rimfire hulls for jackets can be made on this press or on reloading presses.

ing out to form the large bulletmaking firms that bear their names to the present.

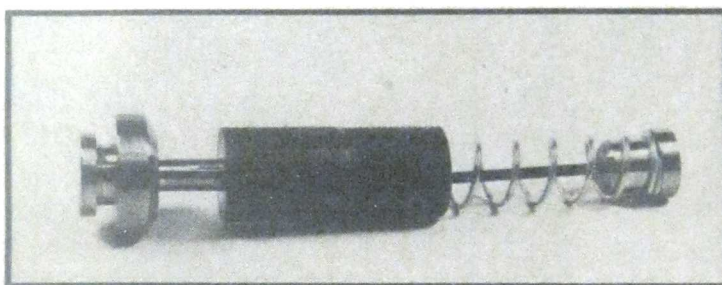
I have made a modest quantity of jacketed bullets in the .224 size from rimfire hulls, but I'd hasten to qualify that by noting my experience is neither of long duration nor deeply extensive. It was interesting, not at all difficult and the resulting bullets outshot some factory loads as well as reloads using factory bullets of impeccable reputation.

The best group I got was around 1.440 inches between centers at one hundred yards, but (1) there was a fierce crosswind gusting erratically from about eight o'clock and (2) the rifle I was using did not perform even close to its usual level.

The equipment used for that session was made by Corbin Manufacturing & Supply (Box 2659, White City, OR 97503); as far as I know, the only supplier of such equip-



Corbin bullet swage dies for making .224 or .243 rifle bullets in home reloading presses have been redesigned with break-resistant ejectors and strong internal return springs for easy operation.



New break-resistant ejection pin and spring shown with die insert of Corbin .224 2-die set.

ment at present. They can furnish dies for use in conventional reloading presses or in their own specialized CSP-1 press. The dies are not interchangeable.

I used the dies for the regular reloading press on grounds that more of my readers owned such equipment. In point of fact, I did all of the presswork on my C-H Heavyweight CHamp press because its massive ram is fully hardened. In earlier times, working with the C-H bullet swaging dies in .38 size, I'd learned that not all reloading presses boast the advantage of a hardened ram. Under the heavier stresses sometimes encountered in swaging the larger bullets, it is possible and fairly probable to warp the lips at the top of the ram on some presses. I refer to the lips that engage the lower flange of the shell holder. I was able to repair the temporary damage, but I really blush to reveal how I did it: My approach involved prying the lips back up carefully with the tip of a large screwdriver...

Use of rimfire hulls involves some amount of advance preparation to get them into prime condition for the operation. First, it's quite helpful if all the hulls in a given batch are of uniform make and type. In general, unplated brass hulls are preferable to the ones that are nickel-plated.

A helpful letter from Dave Corbin on the general procedures suggested baking the hulls in an oven for an hour, with the thermostat set at 500°F, then turning off the oven and letting them cool back to room temperature at their own easy pace.

At the time — it was about August 1981 — the outdoor daytime temperatures were running in the high nineties to low one hundreds and I was reluctant to have the oven of the kitchen range going full-blast for an hour. Instead, I wrapped the batch of sorted hulls in aluminum foil and put them into the alloy reservoir of the RCBS Pro-Melt bullet

casting furnace, with its thermostat at the lowest setting (650°F) and left them to bake for two hours before I cut the current and allowed them to "cool back down" to the three-digit temperatures of the rest of the front yard.

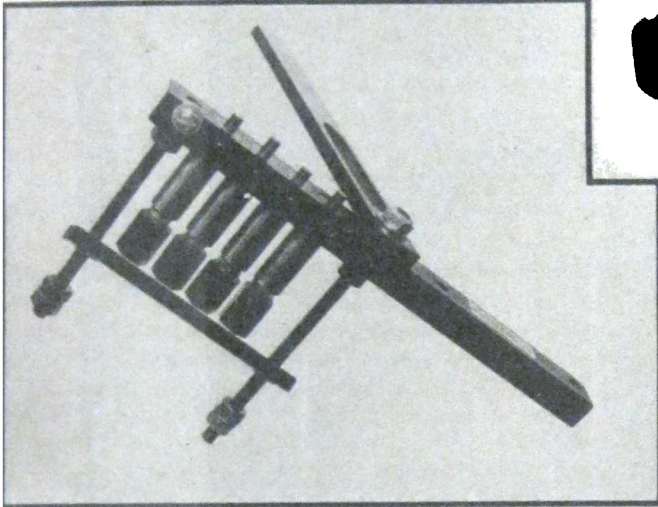
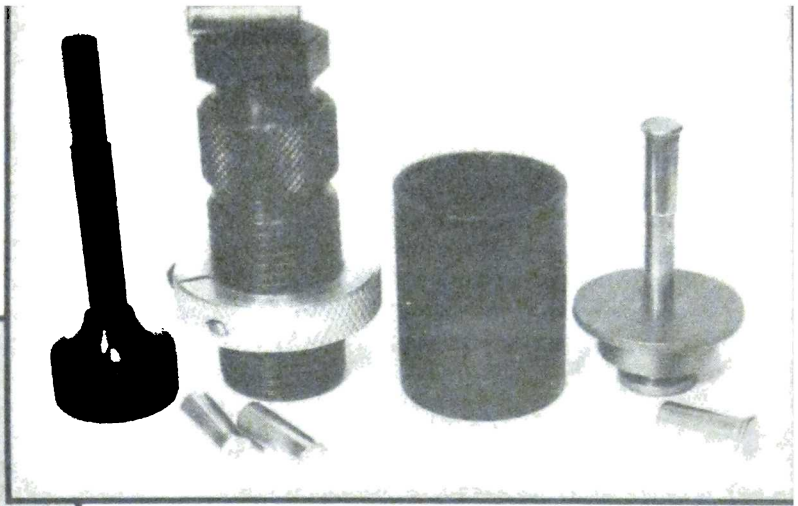
The purpose of that was to anneal or soften the brass so it would form smoothly over the curved foreportion or ogive of the bullet. If you neglect that, Corbin says, you'll get folds and creases and, perhaps, even cracks in the ogive. If you anneal it too well, the base of the bullet jacket may collapse instead of pushing the ogive into smooth contours. Apparently, a couple hours at 650 or so does not result in over-annealing.

A further step is to boil the cases in water, to which a small amount of detergent has been added, followed by rinsing in water with a small amount of added vinegar or lemon juice. The objective of that is to get them cleaned of primer and powder residue. In fact, Corbin suggests that you boil-clean them first and then do the annealing. His reasoning behind that is to kill the priming compound in case the batch of cases happens to contain a hull out of which some prankish soul pulled the bullet without firing the round.

I had obtained my supply of spent hulls by a simple and painless expedient: I had taken son Bill along on a trip to the range and supplied him with a few boxes of ammo and my six-inch Colt Diamondback .22 LR. By the time I'd finished testing a few .41 mag loads, Bill had made spent hulls out of an astounding quantity of rimfire ammo and I was pretty sure he'd not pulled the slugs from any of them!

I find the single aspect of bullet swaging that poses the greatest problem for me is to keep close track of all the various dies, punches and other hardware involved in the

Corbin .224 rimfire jacket maker die comes with new knock-out rod, permitting .22 LR cases to be formed into jackets any of three ways.



Corbin CM-4 core moulds are now available with replaceable, interchangeable caliber pistons and cylinder units, permitting owners to change the caliber or even to mix different sizes in casting.

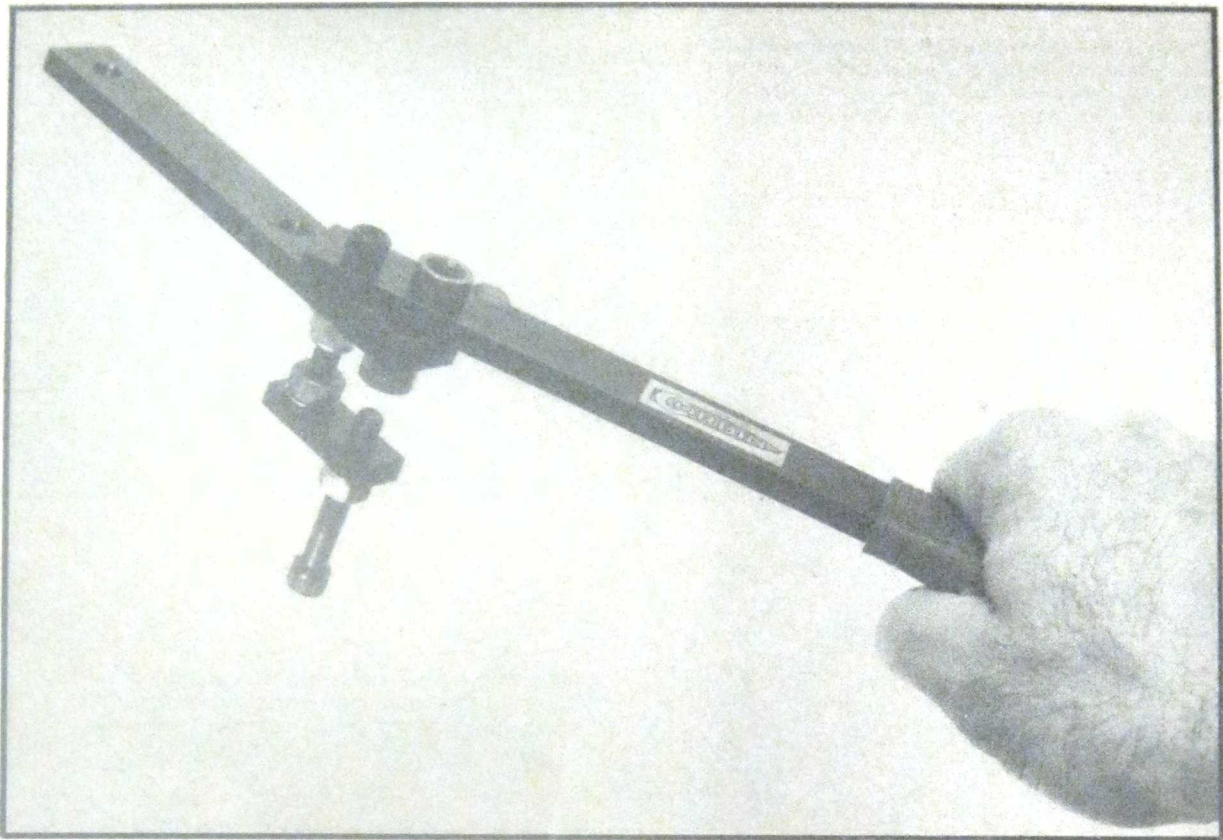
operation. With that ruefully in mind, when the tooling for the project arrived, each gizmo heat-sealed in its own little cocoon with an identifying label, I made up a compartmented tray with a space for each item before I unpacked any of them.

As I cut the plastic open, I removed the typed label and glued it to the side of the given compartment before putting that particular piece away. By means of so incredibly uncharacteristic an approach, I was able to keep track of all the hardware and I've no slightest doubt that it simplified the job immensely. I commend the procedure to your consideration.

After the annealed cases had cooled, I dumped them into a one-quart Revereware stainless pot with about an inch of water over them and added a half a teaspoon of dishwashing detergent — Dawn brand — then simmered them gently for an hour.

Rinsing away the last of the detergent was a considerable challenge. I lost track of the number of times I rinsed, stirred, drained and repeated the operations before the thick suds finally began to thin out appreciably. That Dawn detergent is potent stuff and, another time, I'd be inclined to use it much more sparingly. I did not use an acid rinse although, on thinking about it, there seems a good chance it might've helped to neutralize the detergent. I thought about doing a final rinse with a small amount of water-soluble oil added to the water, but refrained from doing so. It might help or, again, it might not.

I dumped the still-damp cases out into a black cardboard tray that once had held enlarging paper and set the tray on the dash of the old Buick in the driveway, with all the windows up. The combination of black upholstery and blazing Southern California summer sunlight holds an inside tem-



Corbin PCS-1 core cutter for cutting lead wire into accurate weight cores comes with hardened tool steel die inserts designed for longer life and greater uniformity of core weight; It needs bolting to a solid mount.

I had one of the Corbin .22 core moulds, but it was designed to be fastened to the bench and filled with a dipper from the top of the pot. I used to have a lead dipper, but have not seen it in many years. Exercising considerable ingenuity, I reversed the upper portion of my Saeco electric pot so it hung out over empty space and used a pair of C-clamps to secure it to the bench. Then I rigged handles to the mould and provided a shelf to rest its weight upon as I drew it beneath the nozzle of the Saeco pot to run melted lead into the sprue channel: a maverick approach. But it worked well.

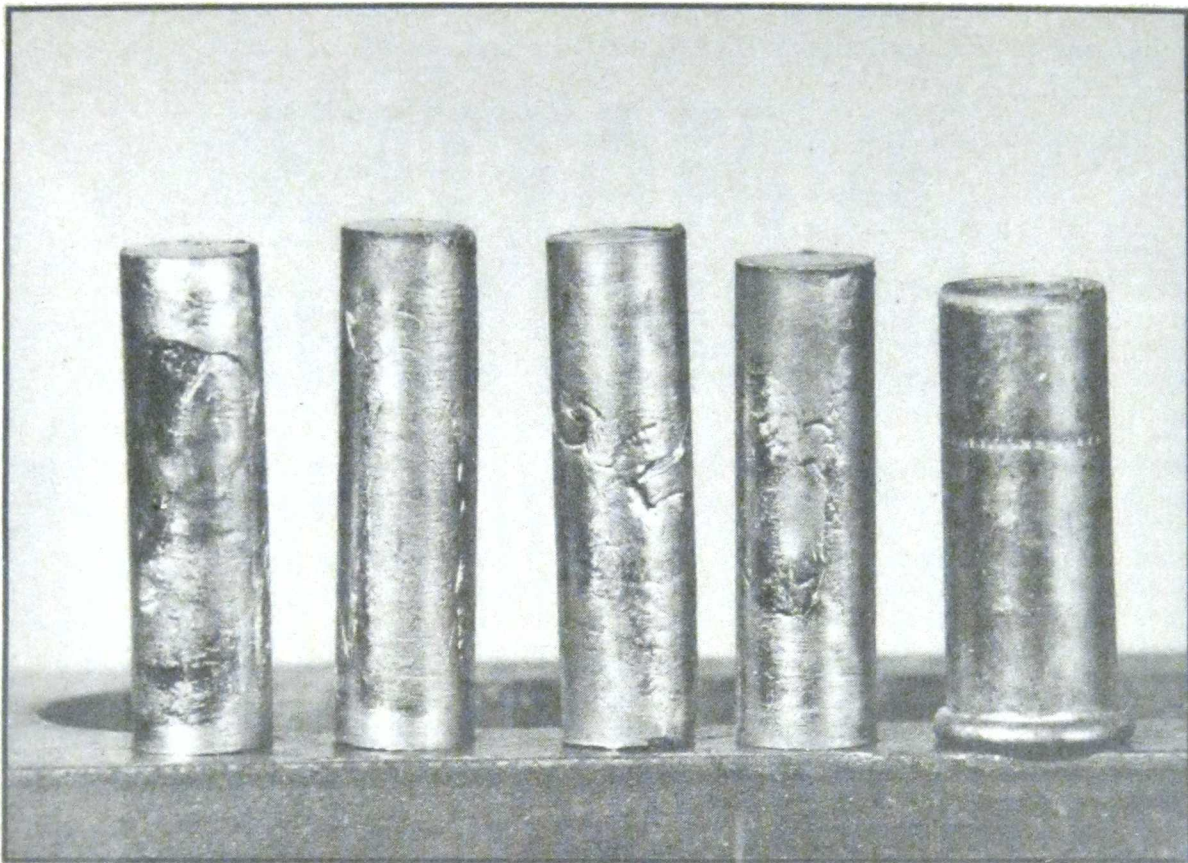
The mould has four cavities and its up/down dimensions are too big to fit beneath the spout of an electric pot in normal configuration, which was the reason for the makeshift system. Each cavity has its own adjusting screw and locking nut to regulate the length/weight of the core it produces. Getting all four cavities adjusted to complete uniformity is neither easy nor simple and I didn't manage it as successfully as I might have wished.

With the keen vision of hindsight, I can see I should have tried checking the setting of the lower piston in each cavity with the depth gauge of my vernier calipers. That should have gotten them fairly uniform, at least. Failing that, or on top of that, the cast cores could've been sorted by weight on a scale or by length with a micrometer.

I tried to get the cores coming out of the mould just a wee tad shorter than the space inside the jacket. When the cores were seated, using the core seating die and punch, they packed in solid to leave a little more open space at the top of the jacket than I really wanted or needed. I found I could fill that in by adding a single Lawrence Brand BB shot and giving it another pass through the core seating die. It seems to work best if the core comes to within 1/8- to 1/16-inch of the upper edge of the jacket, after being seated.

The bullets of that batch came out of the nose-forming die at a weight of about 62 grains and I loaded them into .22-250 cases over 33.0 grains of IMR-4064 — my favorite powder for that cartridge. They chronographed 3300 feet per second (fps) for 1500 foot-pounds of energy (fpe) and, I remain certain, would have grouped under one minute of angle (MOA) if I'd taken a different rifle. Even as it was, they out-grouped some good factory bullets and factory loads, and it's hard to fault such performance.

During the years since that time, I've often felt a yen to try the approach again. An explanation, not an excuse: It does not seem to be the sort of project to which you can effectively devote fifteen minutes today and perhaps another half-hour next week with any hopes of successful results. On the contrary, it fairly well needs to be carried through from start to finish, as nearly as that can be man-



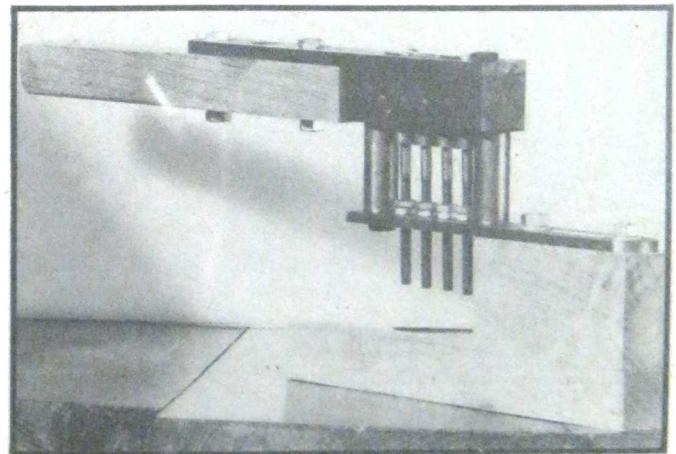
Four of my cast lead cores, with a spent .22 LR hull. I can see now that I should have used the depth gauge of the vernier caliper to adjust and lock the adjustable stems, so as to get all to the same length and weight.

aged. What can be sarcastically termed my spare time does not come in chunks of that size, hardly ever. That is a comment, not a complaint.

For those who want to reload for a .22 center-fire rifle or handgun, who have sufficient time to devote to the operation, I sincerely think it offers a source of pretty decent bullets at a rock-bottom cost in cash out of pocket. Even the accuracy I obtained on the first try is entirely adequate for varmints out to a considerable distance.

Corbin says the typical expectation is that such bullets will not group quite as well as the all-out benchrest bullets from the major bulletmakers, but that they compare fairly well with the average, non-premium factory bullets. If you do not set too high a value on the time you spend, the cost of rimfire-jacketed bullets ~~can~~ get down around a penny apiece.

I hesitate to quote prices in a book such as this because such volumes tend to remain in service over an extended time and prices tend to change, nearly always going up. To offer a rough estimate, assuming you already have a suitable loading press on hand, the tooling to produce such bullets may run somewhere around \$100 to \$150, as of the mid-Eighties. By the time you produce a couple thousand or so bullets, the savings should cancel out the cost of the hardware, fairly well. By that time, you'll probably know



I put these handles of white oak on the basic Corbin core mould for easier operation when casting cores.

more about the fine kinks and wrinkles of the operation than I do on the basis of having only made a hundred or so.

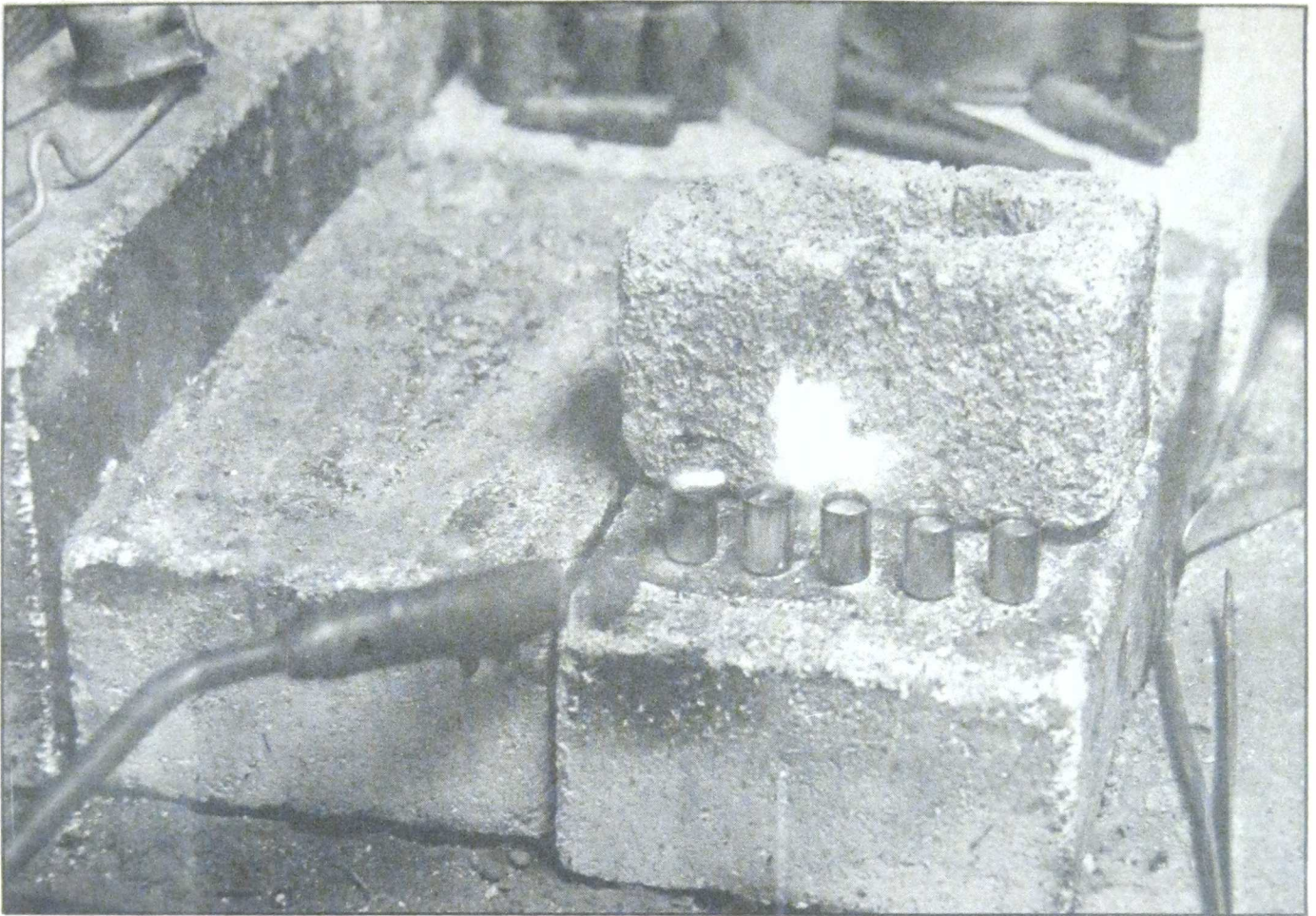
That being the case, if you have any thoughts and comments you'd care to pass along to me (P.O. Box DG, Dana Point, CA 92629-0931, USA), you can be sure I'll scan them with keen interest. Perhaps, by that time, I'll've been able to snatch the time to give it another go and we can compare notes.

A MATTER OF BONDAGE

When You Join The Lead Bullet Core To The Inner Jacket Walls By Chemical-Metallurgical Techniques, It Helps To Make Impact Performance A Lot Better!



Corbin Core-Bond has been applied to the bottom and sides of the lead cores before they were inserted into the jackets in order to metallurgically unite the two alloys of lead and copper before going on to swage the bullet into its final format. When thus prepared, bullets resist high-impact breakup far better than do conventional jacketed bullets that only enclose the core with the jacket.



Jacket at left has been heated with the propane torch until the core melted and fused to the inner jacket walls. Now the torch is playing upon the second one in line. Text discusses the fine points.

(NOTE: The text of this chapter was contributed by Dave Corbin, well-known developer and supplier of equipment and supplies for swaging bullets. — DAG)

DAWN HAS just broken over the mountain tops on the last day of your big elk hunt and you've been quietly waiting near the lake edge, barely moving cramped muscles while your eyes slowly piece together the shapes of shadows along the shoreline. Then, there he is! You knew from his tracks he was a heavy one, but never expected such a majestic bull. As you carefully align your sights in the brightening morning light, what is the best thing you can hope that the bullet resting in the chamber of your rifle will do when it finds the target?

The bullet has a gilding metal or commercial bronze jacket pressed firmly outward by the pressure of a swaged lead core, and the best thing you could hope for is that the combination will stay together on impact, penetrating and expanding together as one unit, finally coming to rest with the same total weight as it had all those days you patiently searched for the trophy. But the reality of most bullet designs is that something will happen to prevent that desired performance.

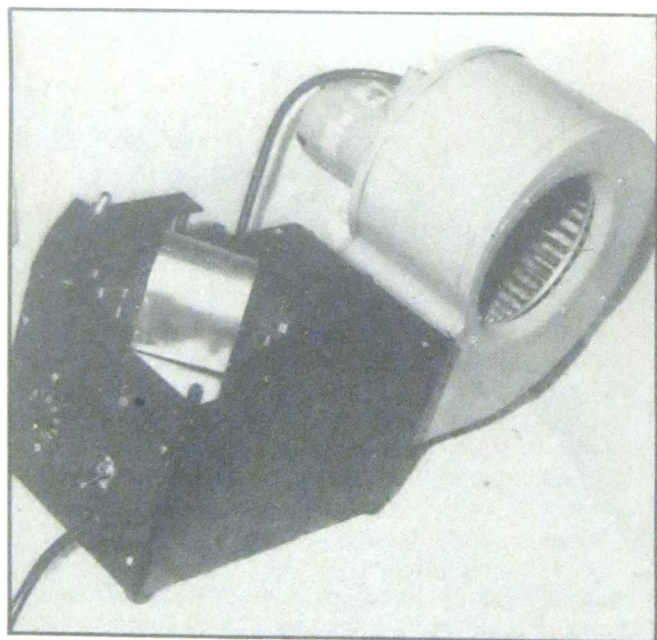
The same kind of bullet that performed admirably last year might strike a bone and shatter on this critical shot. It might peel back just enough to release the jacket's grip on the lead core, and the core might continue forward while the jacket's ragged umbrella stops near the surface of the entrance hole. The core could then break up without sufficient penetration. The difference between excellent performance and a tragic failure is often balanced on the fine edge of metallurgical factors within the thin jacket — stress, brittleness, and tensile strength — which are easily swung into good or bad performances depending on the velocity and resistance at the moment of impact.

It would be nice to push those factors further toward the good end of the performance scale, so that a wider range of conditions in the field would still yield success. Two of the factors can be easily shifted far into the good performance region by a simple technique. The jacket ductility, which relates to both its brittleness and tensile strength, can be increased considerably by heat treatment. The stress that separates the jacket from the core can be channeled into other, more desirable areas of change in the bullet by bonding the jacket and the core together as one monolithic unit.

With a factory bullet, these procedures are not practical. But with home-swaged bullets, they are not only practical



An accurate heat treatment furnace, such as these Thermolyne ovens modified for Athena microprocessor controls by Corbin, permits higher volume production of bonded-core bullets.



Automated heat treatment and core bonding is possible with a machine called the Corbin Model JBM-1, which uses a combination of oxygen-propane flame and air jets to heat and cool the processed units in sequence.

but extremely interesting. The bonded-core bullet, having the lead core actually formed into an alloy that shows copper and lead atoms migrated beyond the physical surface barriers of the two metals and mixed into each other for a permanent bond, is something you can do at home with nothing more than the usual bullet jacket, lead core, and a heat gun or propane torch, plus a chemical fluxing product called Core-Bond.

The first attempts to make bullets with the lead core fastened to the jacket through an intimate bond were solder-related. In order to use a solder, both the inside of the jacket and the outside of the lead core must be clean of any oxides. Both copper and lead immediately start to form a thin oxide surface film in earth's atmosphere, as soon as the fresh metal surface is exposed. In order to make the solder "wet" the surfaces of both metals for a true bond, some sort of flux is required.

A flux is a material that dissolves the surface oxides from the metals to be soldered, and protects the clean surfaces from the air until solder can be applied. Most solder fluxes are corrosive and have to be cleaned off with water or the metals will oxidize at an even faster rate when the soldering is completed. While experimenting with ways to make soldered core bullets, a discovery was made involving a chemical flux that not only required no cleaning off to pre-

vent corrosion, but also had the ability to lower the surface tension of hot lead so much that solder wasn't required to make a copper-lead bond. Leaving out the solder solved a lot of problems, such as the control of bullet weight with unknown amounts of solder added to the precision jacket/core combination.

To make bonded core bullets, a bullet maker needs first to spread a thin film of Core-Bond on a stamp pad, just as a handloader does to lubricate cases. The lead cores are rolled across the pad to pick up a coating of flux. Core bonding will only take place where there is flux on the core, so an even coating is required. The cores are then pushed by hand into their respective bullet jackets.

Donning protective goggles or glasses and gloves, the bullet maker then can use a heat gun or propane torch to heat the jacket/core combinations gently until the lead melts and the flux burns at the top of the jacket with a yellow flame. When the flame can no longer be ignited, the bonding is done. If the core fits snugly into the jacket, it is quite possible that heating the bottom of the jacket will cause the air to expand and blow the hot core out, possibly burning the bullet maker. To avoid this, the core can be held into the jacket with a steel pick while heating the jacket. Heat should be applied slowly, starting from a moderate distance from the flame and slowly moving closer as the lead becomes molten. Once the lead melts and drops into

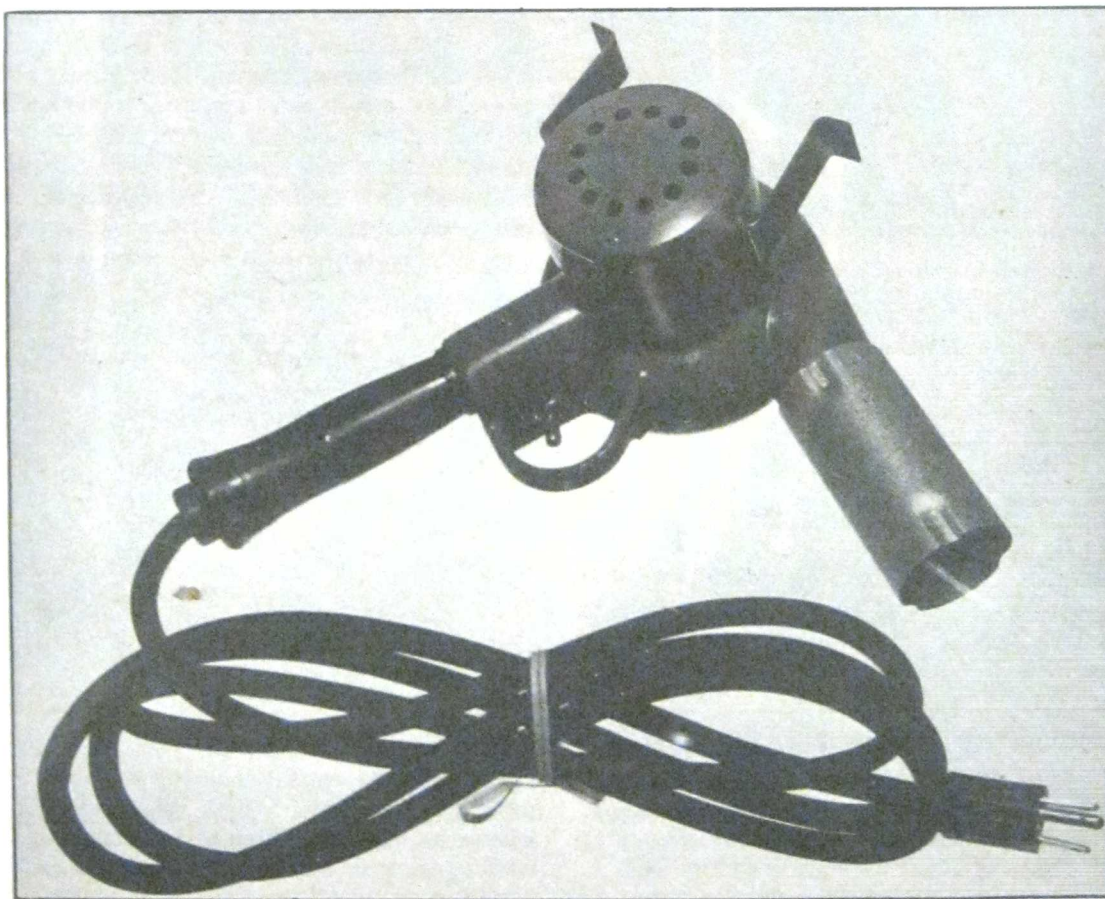
the bottom of the jacket, it will no longer offer any hazard from this particular problem.

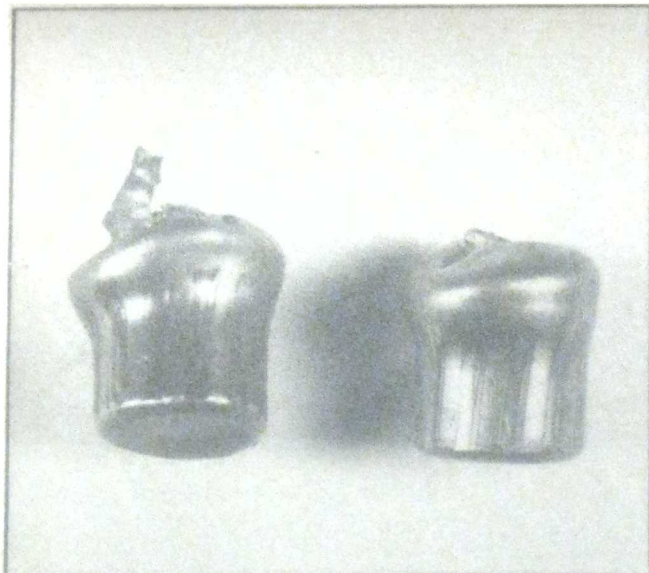
The heating should be done outdoors if possible, but certainly in a well-ventilated location. To hold the jackets and cores upright, fire or boiler bricks can be used as a vise, with other bricks for a protective surface. Large and short jackets, such as those for handguns, will usually sit upright without any help. A sort of "L" made out of two boiler bricks can be used to hold the jackets from blowing around in the flame and to help increase the even heating on the back side of the jacket.

An electric heat gun is an even, controlled way to provide high temperatures but it takes a little longer because of the even spread of the moving air stream. A number of jackets can be stacked in a small can like a tuna tin, and the can placed in a pottery kiln or electric heat treatment furnace. Another method of melting the lead and causing the bonding to take effect is to place a tin can full of jackets and cores in a conventional lead pot. The lead pot will provide sufficient heat to melt the cores inside the jackets after a short time. The can may be placed on a shallow layer of molten lead, in order to avoid overheating of the lead pot elements.

Regardless of how the heating is accomplished, it is important for the lead to be completely melted and to remain molten for a short period of time to allow the copper

Another way to bond cores and heat treat jackets is with the Corbin Model FHG-1 flameless heat gun which provides a stream of 800F heated air.

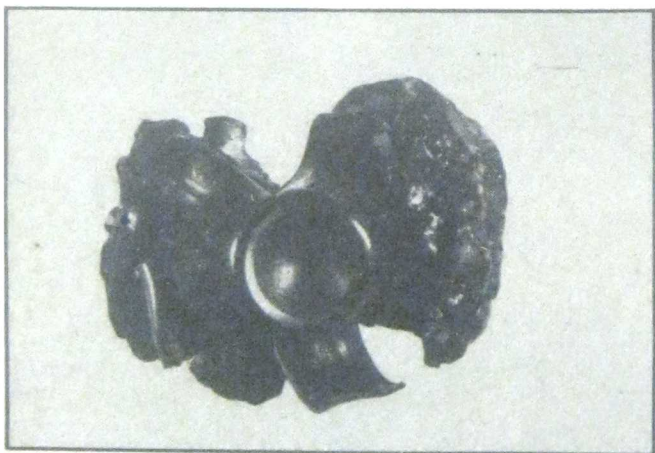




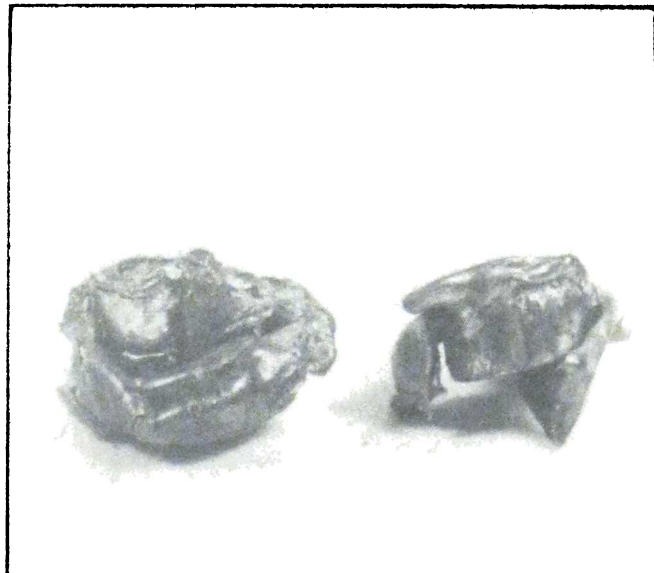
Jackets which have been softened by heat treatment tend to flow back, rather than splitting upon impact with tough target material such as magazine packs.

and lead atoms to migrate into each other. The longer the lead is kept molten, the greater will be the alloy bond formed between the two metals. Tests of various bullets have proven that even one minute of molten state is sufficient time to alloy the two metals. Once an alloy is formed, the strength of the bond is greater than the tensile strength of the lead core itself.

The jackets are allowed to cool, and then placed in a bullet polisher (vibrator polisher unit used by bullet swagers) or a case tumbler with regular polishing medium. They are tumbled until the black crust that forms at the top of the lead core is removed, or at least substantially reduced. Then the bonded-core bullets are made by conventional core seating and point forming operations, just as they would be performed with a regular piece of lead core and



A caliber .45 bullet, bonded as described here, still holds ninety percent of its core, even though nearly blown apart. Conventional bullets at same velocity would be fragmented.



Recovered bullets fired into magazine packs: Bullet at left retained about half its core, folded back evenly: It was heat treated. All that remains of bullets with untreated jackets is the empty bottom quarter of jacket.

separate jacket.

The difference between a bullet made this way, and a conventional factory bullet or one made at home in swaging equipment, is that the core cannot separate from the jacket without actually having the jacket expanded enough to expose the middle of the lead core, and then only if the material through which the lead core is driven is abrasive enough to wear away the lead. The core will not jump out of the jacket on impact, nor will it separate from the jacket when the jacket mushrooms. Both metals will behave as one. They will expand together. If the bullet is driven beyond the combined strength of both jacket and lead by impacting something too dense to permit an orderly expansion (such as a steel target) then the bullet may shatter. Shattered bullets have been recovered, with the bonded core still present on each piece of the jacket!

The point at which shattering occurs is shifted much further to the side of high velocity and hard targets than with a conventional design. Another factor is changed for the good of expansion during the bonding process: The jacket material itself is heat treated as a by-product of bonding. Most commercial bullet jackets are a five percent zinc, ninety-five percent copper alloy called "gilding metal," or a ten percent zinc, eighty percent copper alloy called "commercial bronze" which is not a bronze at all but simply another brass. These metals become more and more brittle as they are drawn progressively longer. The jacket starts out as a flat strip of metal. It is punched into disks which are drawn through dies to make deeper and deeper cups in successive stages. Each stage adds a little more brittleness.

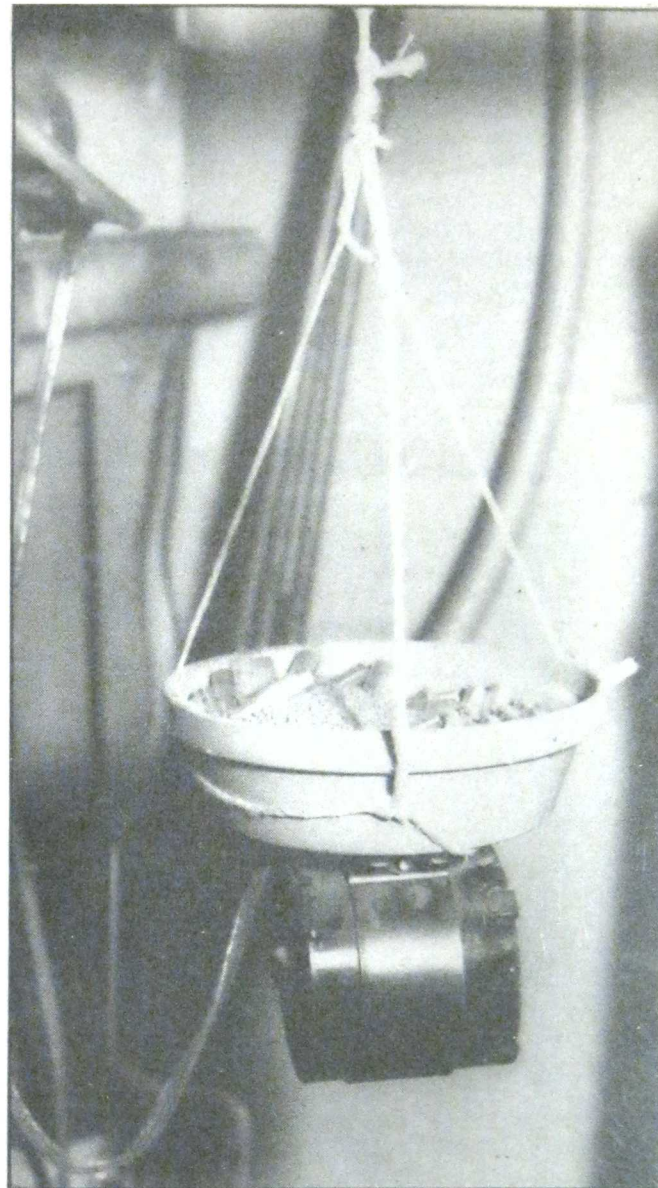
As the jackets become more brittle, they also gain in tensile strength. But tensile strength is perhaps less useful during expansion than ductility. To reduce brittleness, the jackets are heated and left to air cool. This is precisely what happens in bonding the cores. The jackets are left

much more ductile than previously. Economic reasons stand in the way of providing this heat treatment in most factory bullets, because it adds considerably to handling and polishing requirements. At home, it's a simple matter to accomplish.

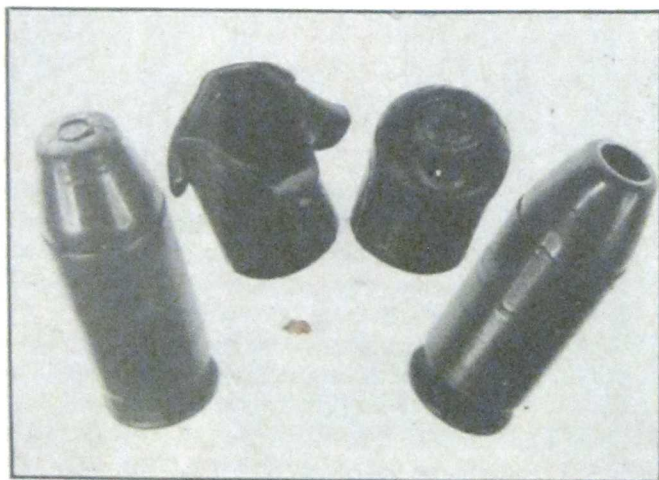
There are some forms of bonded core bullets on the market at this time. Most of them attempt to utilize a soldering technique or a highly cleansed jacket interior and fresh lead to effect the bond. But by far the bulk of the bullets available today are swaged without bonding. Using the bonding technique described here reduces the need for additional jacket thickness, because added support is given to the jacket by the lead itself. Bonded cores can serve to strengthen the bullet for higher-than-normal-velocity firing. If an exceptionally good target-grade jacket is available but it appears to be somewhat too thin for deer hunting, bonding the core within it will increase its resistance to shattering. In metallic silhouette shooting, the bonded core bullet can add precious microseconds to the time a bullet remains in one piece, pressing against the target, and assist in getting those marginal hits.

You might wonder what would happen if a bullet jacket were simply cast full of hot lead without any flux. The lead cools and shrinks slightly away from the jacket, so that if you cut the jacket in half the core could easily be pried out with a pen-knife. If the same jacket and core were bonded as described, it would be impossible to separate the two because the lead would tear and flow at much lower pressure than the bond requires to break. Cutting a bonded core bullet into slices and crushing the slices in a vise will test the bond severely. Only those areas which did not receive any flux will show gaps between the lead and jacket after deformation in this manner. Jackets with hot lead poured into them will immediately separate, upon subjection to this crushing procedure.

If you are not yet familiar with the process of bullet swaging, articles covering the steps can be found in a number of books and most magazines carry stories of further



After heat treatment, Corbin recommends polishing the jackets with their bonded cores. He can furnish a motor kit such as this one for about \$29.50. It fastens to the bottom of a suitable container, which is suspended.



Two similar bullets; a soft point and hollow point with jacket radiused into the opening. On impact, soft point loses its core while the one at right mushrooms evenly.

developments from time to time. Basically, the swaging process is simply the use of high pressure instead of heat to form the bullets. Rather than using a mould that must be heated and cooled in order for the lead to take shape, room temperature dies are installed in a press. The press, which can be a special bullet swaging press or in some cases a standard reloading press, applies pressure through a punch and causes the lead to actually flow at room temperatures.

The pressure inside a bullet swaging die often exceeds 20,000 pounds per square inch (psi), but the force on the press handle is about like sizing a case. Swaging dies for jacketed bullets usually come in sets of two or more, used



Core-Bond flux makes the difference between the shattered bullet and core jump of the two upper bullets and the fully retained weight in both bottom bullets, all into the same medium at identical velocities.

in sequence, to complete the bullet. At the least, a single die can be used to form a semi-wadcutter bullet in one stroke. To move the jacket around the nose or ogive section, two dies are required. The first one applies high pressure to expand the lead and jacket to a perfectly round and precise diameter. The second die shapes the ogive on the bullet.

For more precision work, a core swage is included in the set. This die has bleed holes in the side at regular intervals so that it can extrude surplus lead from the cut or cast core. The press is set up so that there is a fixed volume of space between the top and bottom punch, within the die. When a

slightly heavier than desired core is inserted into the die and the punch run in behind it, this volume of space is constantly repeated. Any extra volume of lead is extruded out through the bleed holes. The resulting core is almost a perfectly uniform weight from one to the next.

Bullet swaging equipment gives the handloader the ability to make all kinds of weights and styles with one basic set of dies. The process lends itself to experimentation, and some of the experiments lead on to improvements in bullet performance that are not obtainable any other way. The experiments with bonded cores and heat-treated jackets are easily repeated by anyone with bullet swaging equip-

ment. Several individuals have now taken the idea a step further and started their own part-time businesses making and selling custom bullets with bonded cores. With the proper equipment, copper tubing can be used as a bullet jacket. The bottom of the jacket is formed from swaged metal and it is possible to close the jacket completely, if desired, on one end. Bonding cores inside a copper tubing jacket gives both a ductile, tough jacket and remarkably tough construction.

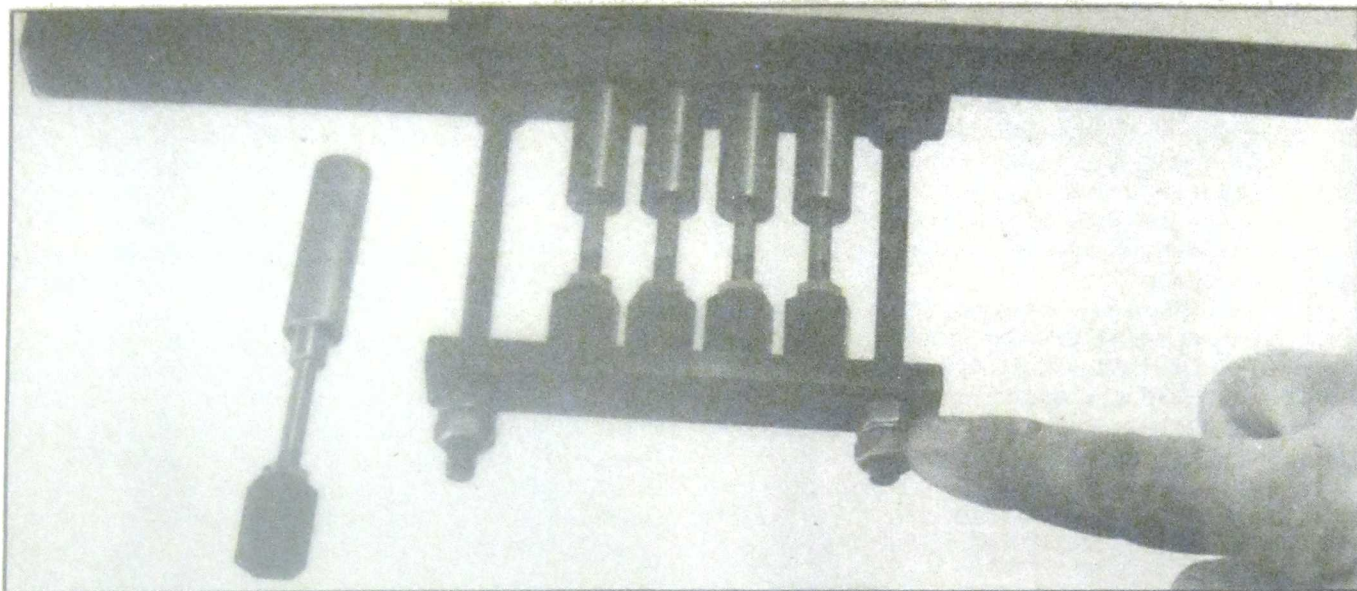
There is one problem with bonding tubing jackets: In the more open bases that can be formed in hand swaging presses, the hole left in the bottom of the tubing jacket needs to be sealed to keep lead from running out. The programmable hydro-presses now on the market eliminate this problem by swaging the tubing material completely shut, even with tubing material as thick as 0.125-inch in the walls! This much pressure is beyond the usual hand press system. Dies of 1.5-inch diameter are used in the hydro-presses to sustain up to 150,000 psi levels.

To seal the open end of the tubing jacket, one can simply press a gas check or short jacket into the tubing. In a .375 bullet jacket made from three-eighths-inch water tubing, a .30 caliber gas check makes a good seal. Some bullet makers use a pop-rivet, others swage a brass tack or brad into the hole. However it is done, the hole must be tightly sealed to prevent hot lead from flowing out during bonding. The lead surface tension is lowered so much that it escapes through tiny holes that it would not normally be able to negotiate.

The manufacture of tubing jackets is another tale, but suffice it to say that a kit of dies and punches used in the various presses (but not reloading presses) is produced for the range of calibers starting with 7mm and ending, at this time, with the .505 Gibbs and .50 Browning machine gun bullet. Tubing bullets are usually not worth the trouble if there is an adequate commercial jacket available, but they come into their own when the only jackets around are too thin or there aren't any long enough or tough enough in the



A bullet trap built to test handgun and rifle bullets for retained weight is made of plywood, filled with two hundred pounds of oiled sawdust in three compartments. Length is six feet.

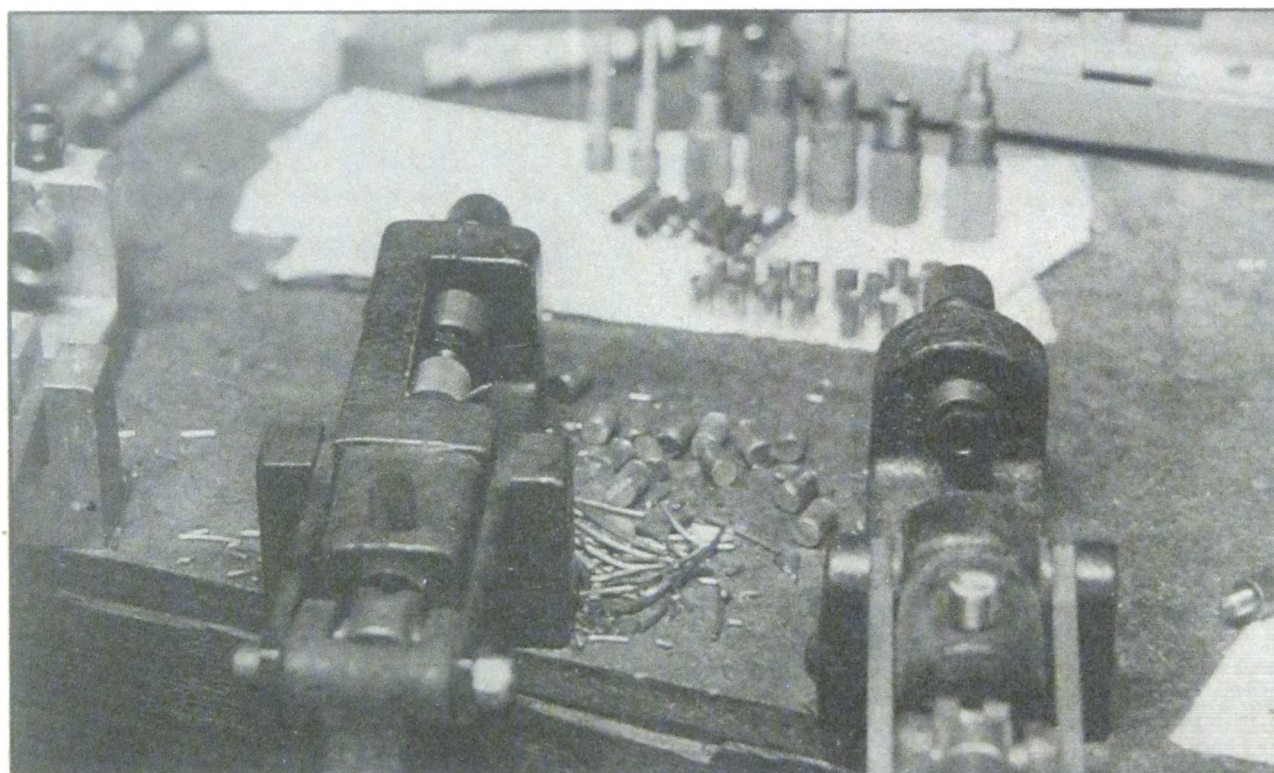


Lead cores can be cut from a roll of lead wire or cast in this four-cavity, adjustable-weight core mould. They are then swaged to precise weight and shape to fit inside the bullet jacket.

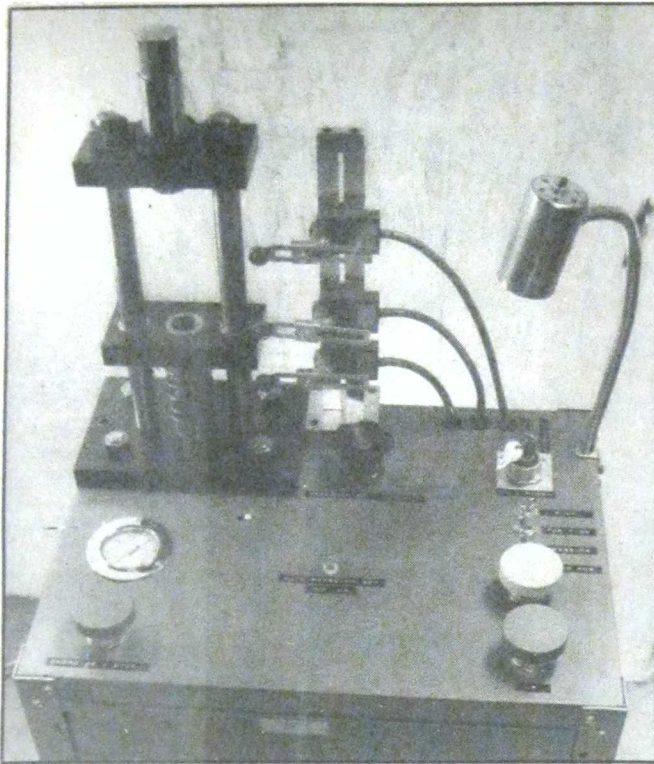
caliber of interest. From .30 caliber down, there are usually plenty of good jackets on the market. Bonding the cores to the existing jackets gives them a performance level up with the tubing type.

Further information on bullet swaging and core bonding

is available for the asking, although a self-addressed stamped envelope helps expedite the reply, from the author, c/o Corbin Manufacturing & Supply, Inc., P.O. Box 2659, White City, OR 97503. He can also supply the Core Bond flux.

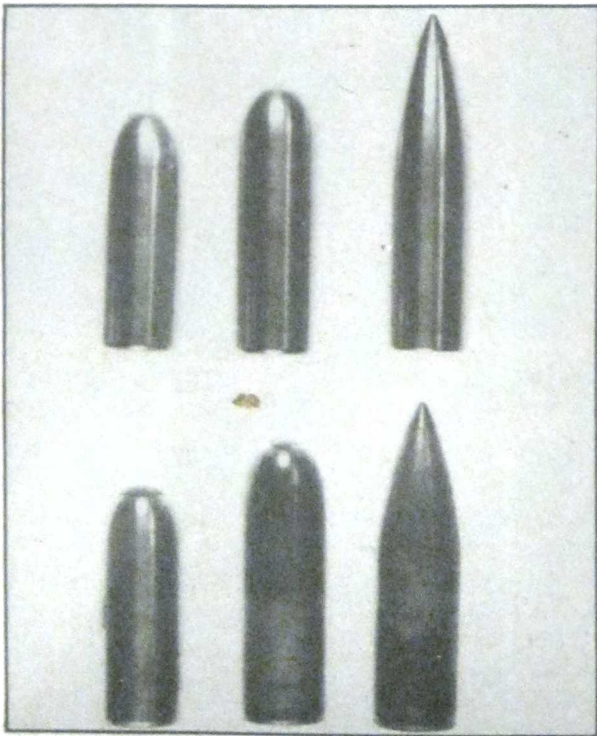


Bullet swaging presses for home use include the Corbin Model CSP-1 versions. Press at right is an early type without the reinforcing upper member of the one at left. Cores for a .45 bullet can be seen here being swaged to final weight and shape. Wires are the bled-off extrusions.



Corbin Model CHP-1 Hydropress is a programmable, pressure and position sensing, semi-auto bulletmaking and reloading press for the advanced reloader or custom bulletmaker. It has highly advanced capabilities.

Bullets made for African big game using heavy-wall brass tubing (70 copper/30 zinc alloy) can be improved by heat treatment so they will expand without shedding jackets. Control panel of the CHP-1 Mark II press is shown. It will produce bullets from .172- to .512-inch diameters and can reload any cartridge up to and including 20mm cannon. Standard reloading dies are adaptable to it and pressure can be set to safe levels for any operation.



Bullets with jackets of copper tubing in thicknesses of .035-, .049- and .065-inch, formed in dies for the Model CHP-1 Hydropress. Shiny ones at top were tumble-polished before final point forming. Discoloration resulted from heat treatment during production.

THE .450 ZEPHYR

Claud S. Hamilton Reports Upon Experiments
With Ultra-Light Bullets In The .45 ACP



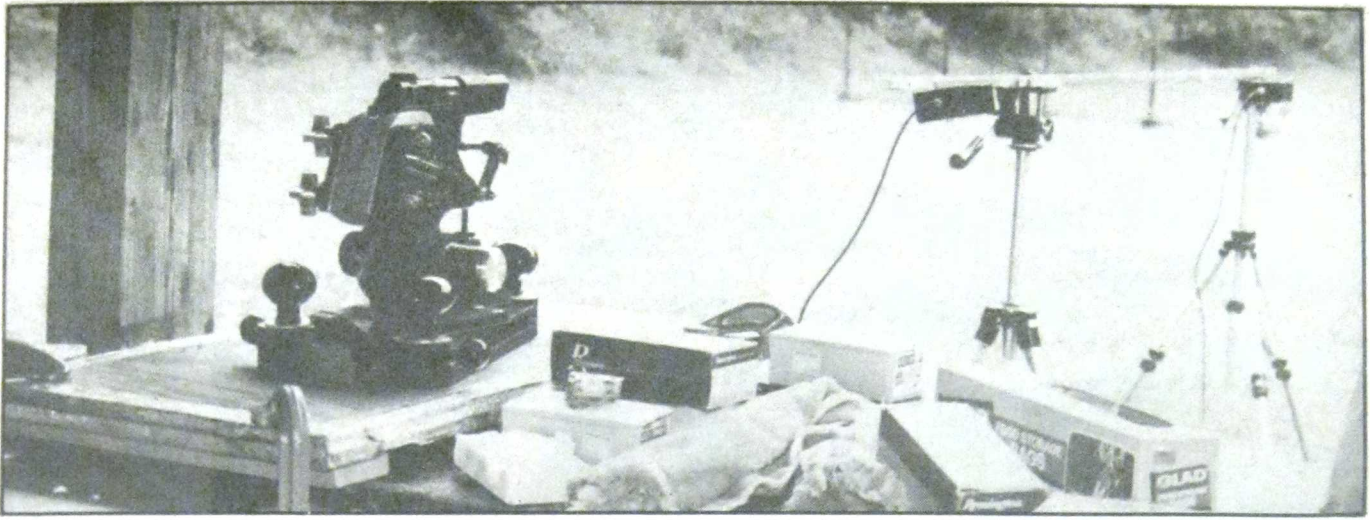
Here's a view of the testing operation out of the Ransom Rest, firing over the Tepeco Speed-Meter II chronograph.

HAVE YOU ever wondered just how much velocity you could wring out of a "conventional" handgun? I have, and I also get a kick out of taking an occasional "excursion into the unknown" — to discover things about guns and bullets and powders that we don't now know. Such trips are not without a certain element of danger, and that seems to sharpen the flavor of success a bit!

Most experimentation of which I am aware seems to take place with single-shot handguns or revolvers. There

are good reasons for this; one can maintain closer control over spent cartridge cases and inspect each one after firing to catch signs of excess pressure both in primer treatment and extraction difficulties. No less important, these arms tend to be more strongly built than pistols in the chamber area.

I have sometimes described my forty year relationship with the .45 Model 1911 and A-1 as a "love-hate" one. The old gun and its cartridge have fascinated me ever since we first met just before WWII. And yet, the combination



Another view of the system of mounting chronograph skyscreens on top of photographic tripods: Aim with care!

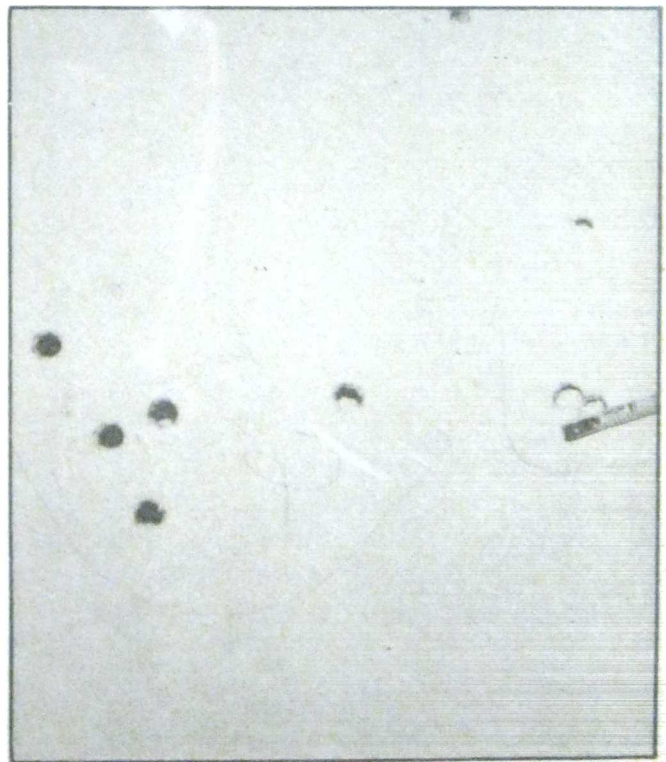
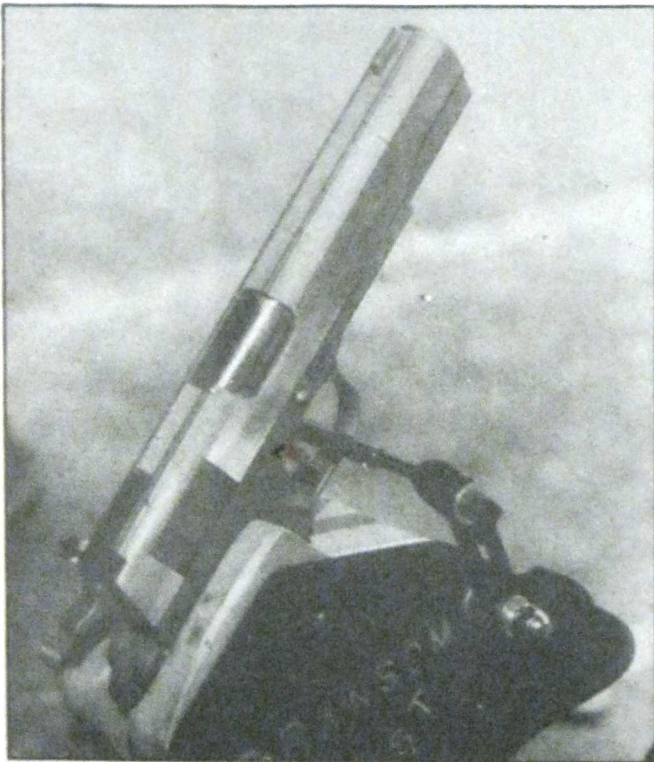
has always left me with vague feelings of inadequacy in power and accuracy. I guess it just must be that we so rarely shoot Indians off horseback at twelve to fifteen yards these days...that is just what the old gun was designed to do best! No, we want to stretch it into an all-purpose handgun for modern needs, and the old bullets are just too heavy and slow for twenty-five- and fifty-yard shooting. In recent years much work has been done to improve the accuracy of the old gun itself, and some of the "new" light bullets have been adapted for it, but the results in my own opinion have been only marginal. In my experience the jacketed hollow points just do not expand reliably at velocities achievable in the .45 ACP.

It must have been these vague feelings of unease which

led me a while ago to set out to see just what velocities I could safely attain in ordinary, unmodified Government Model pistols. Originally, I made the tentative decision that I'd christen anything that might result — in the true spirit of these modern days — the ".450 Ultimate." After sober reflection, and considering the true nature of what I got, it seemed the present title was so much better a fit!

The natural laws which seem to apply to powders and bullets state that you can achieve increased velocity in three ways: by using more powder, by using lighter bullets, or a combination of both. Increased powder charges offer no viable answer; they just raise pressure beyond safe limits. Lighter bullets do move out faster, but over a year and more of experimentation, I have learned that you quick-

Left, AMT Hardballer was used in the test. When using the Ransom Rest, a case catcher cannot be used, so one shooter did the firing while the other tracked down the cases. Right, accuracy was reasonably good.



ly reach the point of diminishing returns. The best approach seems to be to use both more powder and superlight bullets. Superlight bullets, to me, are much lighter than the present-day conventional bullets. I am speaking in terms of 100 grains or even less for the .45!

Such bullets, unfortunately, are not commercially available. Fortunately I have access to one of Dave Corbin's Mity-Mite bullet swaging presses and a lot of his good advice, which enable me to do things not otherwise possible.

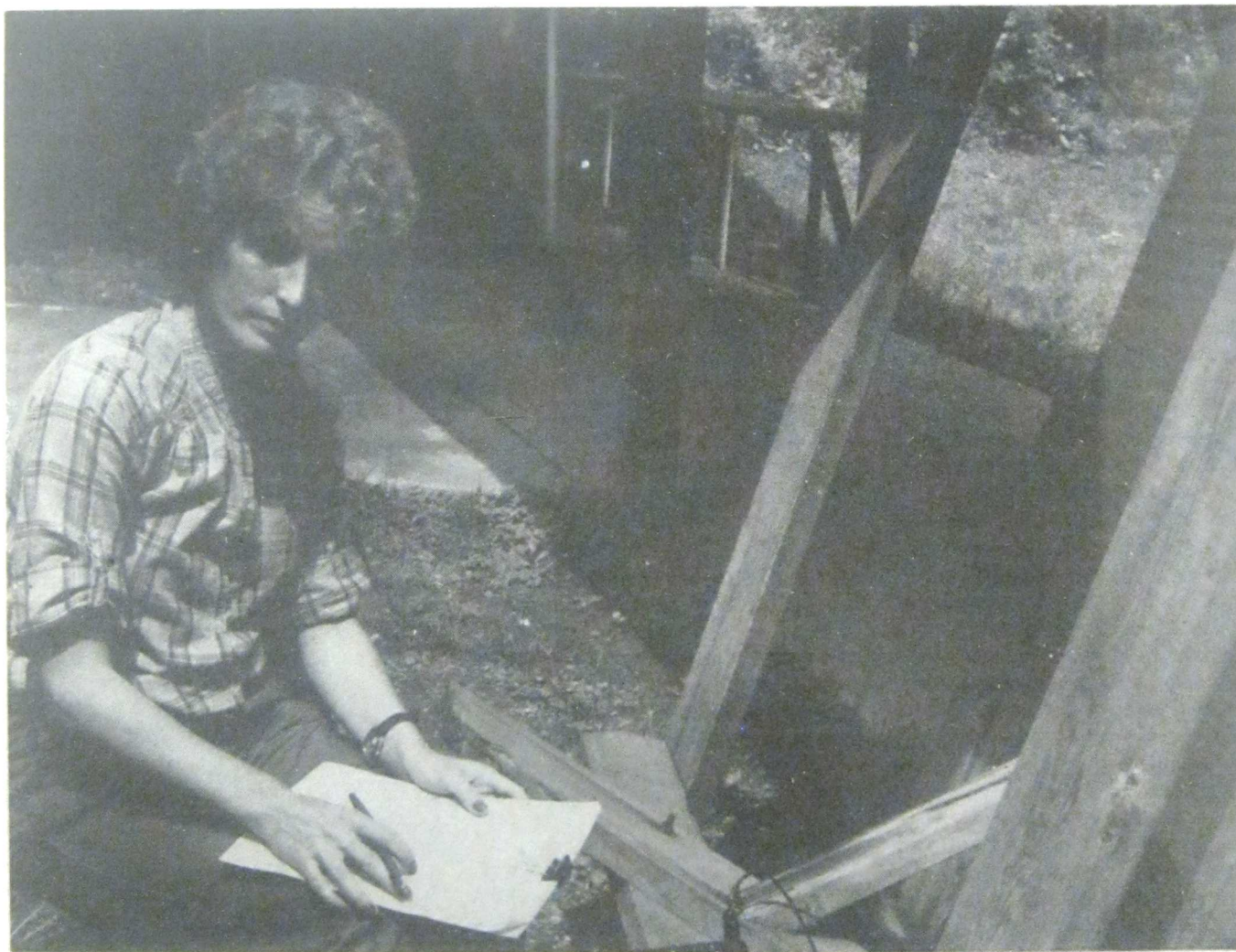
Bulletmaking involves first, weighing the available jackets. Subtracting the result from the weight of the bullet you want to make tells you how heavy the core may be. I had already done some work with the .45 Colt revolver and knew that I could make good bullets down in the 120- to 140-grain range, but I wanted to go even lighter for the .45 ACP.

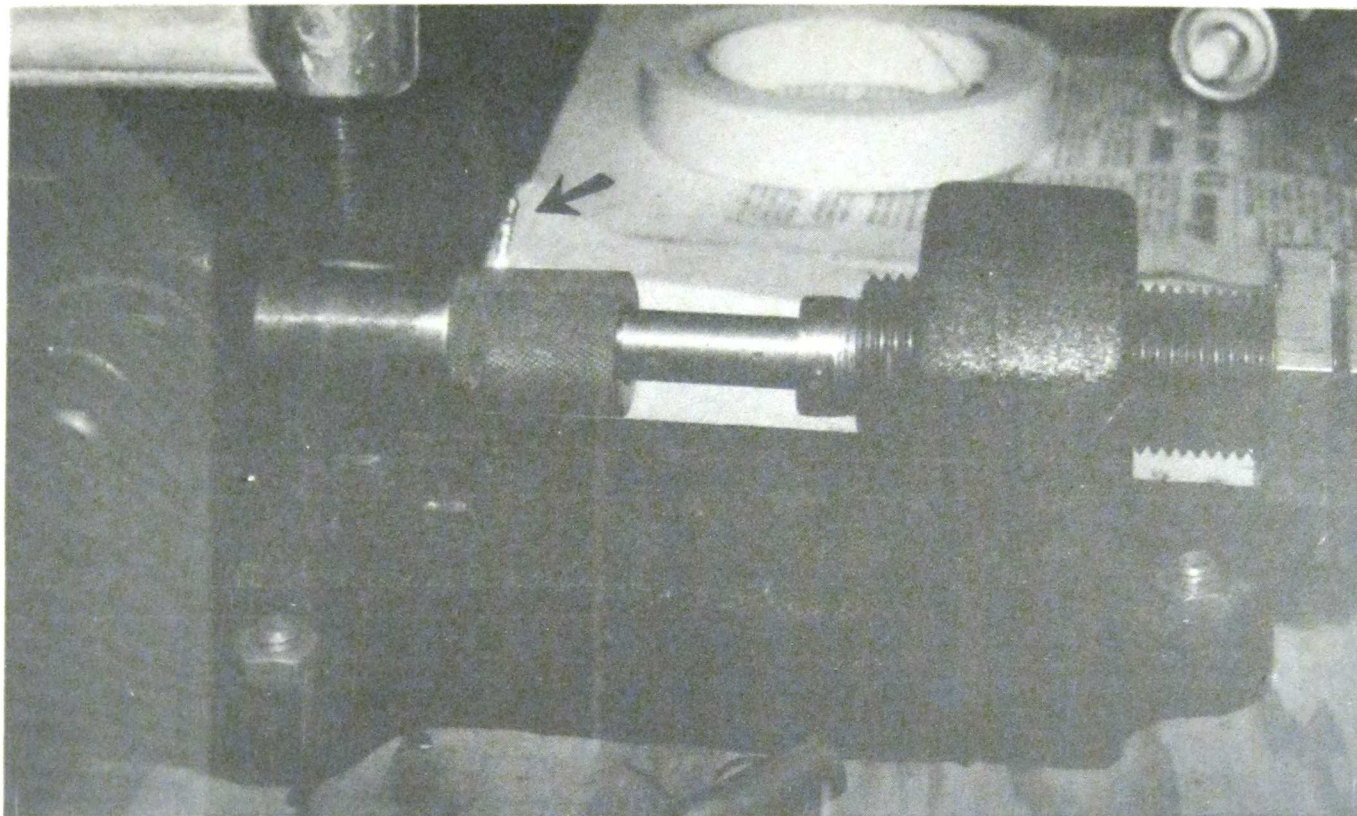
I had two sizes of .45 jacket. The larger weighed in at 47.5 grains average, and the smaller at or near 33 grains. I soon found that I could make cylindrical bullet cores of soft lead weighing about 60 grains using Dave Corbin's core forming die in .41 caliber. I made some of these, then went on to see what the smallest core I could make might weigh, and found that to be 30 grains. I used the larger core with

the larger jacket, and the smaller with the smaller, coming up with bullets weighing 108 and 63 grains, respectively. The short jacket, however, has such a limited bearing surface that I honestly doubted that it could be loaded into a case tight enough to work safely through the pistol. Even if it could, there seemed to be a real danger that the bullet might turn in the barrel and jam there, not a pleasant development to contemplate. So, it seemed wise to hedge my bet with another light bullet using the long jacket. For the core I turned to beech wood dowel which happened to be available in precisely the right diameter. This gave me a bullet weighing a little over 53 grains.

I decided to swage my bullets as full metal jacket wadcutters primarily because I wanted to see what sort of effect such bullets might have on impact at higher than normal handgun velocities. I curved in the noses just enough to permit me to load them "out" so that they could work through the pistol magazine system, and still chamber properly. My earlier work with revolvers had always used jacketed hollow point bullets since I was interested to see what the effect might be in clay and thus for defense purposes. One thing interesting I learned was that at velocities up to the 1800 to 2000 feet per second (fps) range, it is very

Martha Penso prepares to record chronograph results behind the upturned picnic table that was used "Just in case" at the commencement of the tests. As Hamilton acquired confidence in the loads, shield was not used.





The Corbin bullet press, with the core-forming die installed. Excess lead can be seen extruding from die.

easy to shoot a core right out of a jacketed hollow point, even one that is well bonded in. It seems that as the bullet initially accelerates through the smooth throat of the revolver cylinder, it suddenly begins to cross the barrel gap and encounters the rifling. With jacketed bullets the friction resistance is considerable, and a sudden, sharp deceleration results. The core zips right out the open nose if one is not careful! I did not think that such a thing was likely to happen with the .45 pistol, which has neither a smooth throat nor a barrel gap.

Without a doubt, the hardest part of working with superlight bullets is the problem of determining "safe" starting charges of powder. I thought that there ought to be a logical, mathematical way to approach the matter and so tried using the inverse ratios of bullet weights. Then I "refined" that and tried the inverse ratios of bullet sectional densities. Neither approach gave me results that I could have much confidence in because well before I reached bullets as light as those I had in mind, I was usually getting charges that were well beyond case capacity!

I know it must pose a simple problem for the fine, ballistic engineers in the loading plants, but for me... well, I went back to the old tried and true system. I selected charges for light conventional bullets that were sure to be safe and then worked up from there a little at a time until I got the sort of velocities and pressure signs that told me to stop. A slow process, but it works and it is safe!

For no good scientific reason I started my superlight bullet work with revolvers using Blue Dot. I soon learned that Blue Dot simply cannot handle them. I worked my way through .41, .44 and .45 Colt and, in each case, sooner or later, Blue Dot would blow out of the muzzle and burn out

there. I changed to the new 800X powder for a while, and did get a little more velocity, but that, too, soon "topped out." At that point I changed to Unique which has a long-standing reputation for being just that: Unique.

When it came to work with the M1911 pistol, I had the advantage of my earlier experiments. It seemed logical to determine starting charges by comparing case capacities of the .45 Colt and .45 ACP, and then reducing the charges used in the .45 Colt accordingly. These I found to be:

.45 Colt: .45 ACP = 41.8 : 25

Charges were then computed to be:

.45 Colt Loads	.45 ACP Loads
108-grain bullet, 19 grains Unique	11.3 grains Unique
66-grain bullet, 20 grains Unique	11.8 grains Unique
53-grain bullet, 21 grains Unique	12.4 grains Unique

These are enormous charges of Unique powder and far exceed anything safe with bullets of conventional weight. They must never be used except with bullets of the weights shown, and only then with great caution.

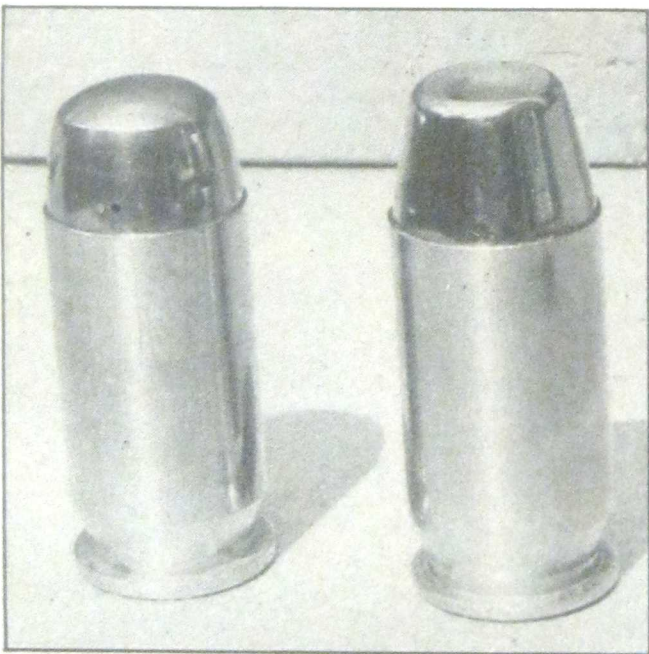
When loading time came, my earlier suspicion proved correct; the tiny 66-grain lead-cored bullet was too short to be practical or safe, so I discarded it.

When all was ready, two friends and I made our way out to the Fairfax Rod and Gun Club ranges complete with Ransom Rest and chronograph, loading press, powder, powder scale and the rest of the essentials for loading at the firing point.



Impediment of the experimental lightweight bullets in clay showed a large opening, tapering on down.

Load at left carries the odd-shaped FMJ bullet, as compared to a conventional JHP load at right.



It takes so little effort to be safe rather than sorry. For the first few shots we erected a heavy picnic table between ourselves and the gun on the Ransom Rest, and fired by "long lanyard." All my past experience told me the starting loads were safe...but we can all make mistakes!

Soon I felt confident with the loads and began to increase them 0.1-grain at a time. I stopped at these:

108-grain lead core bullet, 11.8 grains Unique, 1840 fps

53-grain wood core bullet, 13.0 grains Unique, 2074 fps

These loads showed no signs of excessive pressure and the primers were not severely flattened *in my gun*. The reader is cautioned against any attempt to duplicate them; your gun and mine do not react to pressures in the same way!

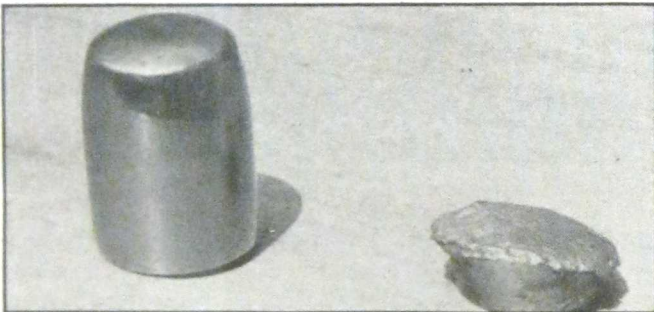
One problem encountered with these loads in pistols is that they do not offer enough recoil to cycle the action reliably. This was true even with the heavier bullet.

Accuracy with these light bullets surprised me by being indistinguishable from that of conventional bullets in this gun. Groups were about three inches or less at twenty-five yards.

After my experience with the jacketed hollow point



Longer jackets, at left and center, with both lead and hardwood cores. Short jackets did not perform well.



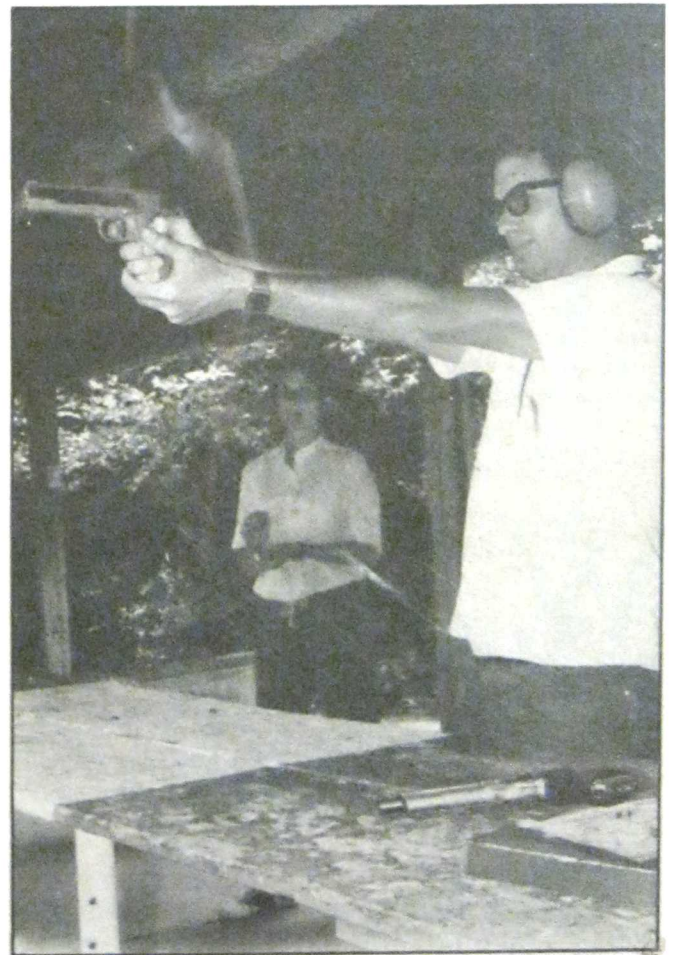
Lead cores usually were recovered after firing into clay, but wood cores tended to disintegrate on impact.

superlight bullets in clay, I was interested to see how these would perform. The JHPs had penetrated about an inch into the medium then virtually exploded leaving a ball-shaped cavity about two to three inches in diameter. They had not penetrated more than four inches in the clay including the cavity, and all that was recoverable were fragments of core and jacket.

With my new full metal jacket design there was a difference. The largest cavity was at the point of impact of the flat nosed bullets, and the "wound channel" grew progressively smaller thereafter. Total penetration was about six inches for the 108-grain lead core bullet and 4½ inches for the wood core bullet. The lead cores were recovered usually with minimal damage and loss of weight, but I never found anything of the wood cores but sawdust. Jackets were unrecoverable in either case.

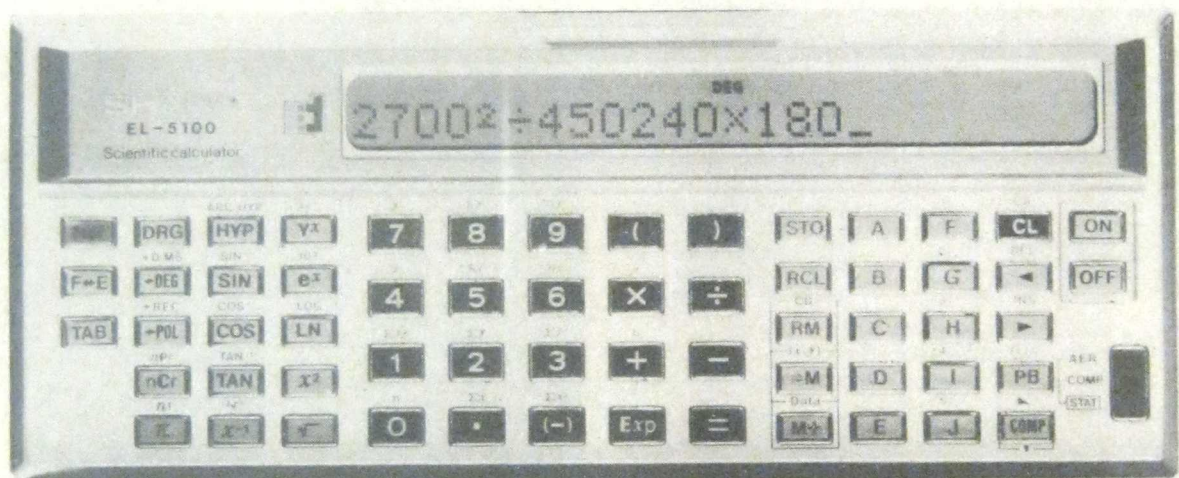
One of the important points I learned from this experiment was that it takes a certain minimum weight of bullet to cause a recoil-operated, semi-automatic pistol to cycle properly. Increased powder charges alone will not do it. With the Government Model, it seems clear that this minimum weight is greater than 110 grains...perhaps in the 150-grain range. I did not pursue the matter to find out.

Heywood Nelms fires a few preliminary shots through the AMT Hardballer to "dirty the bore" before going on to conduct the test groups in the paper targets.



MATH FOR RELOADERS

Angstroms To Parsecs, Three Aspects Of Kinetic Energy Plus Momentum, The Bare Bones Of Trig And Assorted Other Good Stuff



I'm not certain if the Sharp Model EL-5100 remains available, but I regard mine as an ideal tool for "ballisticalculations." Here, it's set up for getting the energy of a 180-grain bullet at 2700 fps. A touch of the =-key provides the answer: 2914 fpe, rounded off. When programmed in dialogic mode, it "asks" for velocity and bullet weight and feeds back the energy. It retails/retailed for a little over \$60. More than a mere calculator, it's a sort of liliputian computer — liliputer???

WITH A POCKET calculator — or with a pencil and some scratch paper, in a pinch — it's possible to obtain quite a bit of useful information with the aid of procedures outlined in this chapter. I'll try to keep it as clear and simple as possible, illustrating with a few examples and supplying some timesaving shortcuts, with explanations on how and why those work. Individual topics will be indicated by headings, to help find the needed dope as quickly as possible.

BULLET ENERGY

The classic formula reads: Velocity (in fps) times itself, divided by 7000 (the number of grains in one pound),

divided by 64.32, times weight of bullet in grains, equals bullet energy in fpe. If the abbreviations are unfamiliar, fps is feet per second and fpe is foot-pounds of energy.

The figure of 64.32 represents twice the acceleration of falling objects on the particular planet. Such items accelerate at a rate of 32.16 feet per second per second (fpsps) and twice that is our factor of 64.32, as given above. The quoted figure is the common one usually given in physics textbooks. There are others, varying very slightly from 32.16 and we'll discuss those later. They really don't change the final answer significantly, so we'll stay with the familiar figure for reasons I'll point out shortly.

For convenience and clarity, let's adopt a few abbreviations, or call them symbols, if you wish:

V = Bullet Velocity in fps
W = Bullet Weight in grains
E = Bullet Energy in fpe

With that agreed upon, we can now boil it down to:

$$V \times V \div 7000 \div 64.32 \times W = E$$

The customary term for $V \times V$ is "Velocity squared," which is conveniently written as V^2 .

Instead of dividing first by one number and then by another number, we can get precisely the same answer if we multiply one divisor times the other and then make a single division by the product of that multiplication. As an illustration, if we divide 12 first by 3 and then by 2, we get 2 as the answer. If we multiply the divisors times each other ($2 \times 3 = 6$) and divide 12 by the product (6), we get exactly the same answer of 2.

If we multiply 7000 times 64.32, we get 450,240 as the product. If we square the velocity and divide that by 450,240 and multiply the resulting quotient times the bullet weight in grains, we end up with the same figure for the bullet energy and we save some amount of key-punching or doodling on scratch paper.

The factor, 450,240 is such a handy timesaver that I customarily give it the abbreviation or symbol of F (for "Foom-Factor"). Let's give our formula one final boil-down:

$$\frac{V^2}{F} \times W = E$$

In algebra, it's customary to vocalize V-squared divided by F as " V^2 over F," and set it down on paper as it appears here. If you're more comfortable with straight arithmetic, think of it as:

$$V \times V \div F \times W = E$$

Now that we have that fairly well wired down, let's try it out. Suppose we have a 180-grain bullet, going 2700 fps; what is the energy?

$$2700 \times 2700 = 7,290,000$$

$$7,290,000 \div 450,240 = 16.19136461$$

$$16.19136461 \times 180 = 2914.445630$$

Rounded to the nearest whole number, the answer is 2914 fpe.

One further timesaving shortcut: If you're working out the answer for several different velocities, all with the same bullet weight, you can simply divide the F (450,240, remember?) by the bullet weight to get a corrected factor — for that particular weight. Thus, for the 180-grain bullet, F divided by 180 is 2501.333(...), with the parenthetical dots meaning the threes would go on to the end of time and never come out even.

Let's check that against our example at 2700 fps:

$$7,290,000 \div 2501.33333 = 2914.445629 \text{ fpe}$$

The minor discrepancy — .000001 fpe — is due to calculator error and not to any glitch in the basic formula. That's one-millionth of a foot-pound and it sinks out of sight when we sensibly round the answer to the nearest whole number: still our original 2914 fpe. I only tossed in the decimals to demonstrate how close it comes to giving the same answer.

Why do we worry about bullet energy in the first place? I think it gives a neat summation of the end-potency of the given load. If we say we have a 180-grain bullet going 2700 fps, we have no ready means to compare it to a 165-grain bullet going 2820 fps. Which of the two has the most energy?

Well, as it happens, we have the ready means of finding out:

$$2820 \times 2820 = 7,952,400$$

$$7,952,400 \div F = 17.66257996$$

$$17.66257996 \times 165 = 2914.325693$$

which, rounded off, is 2914.

Hey, they wound up the same, give or take the random decimal! How about that? How did he *do* that?

Well, there are two other sides to the same — uh — coin. Given two factors, we can always work out the third. Given velocity and bullet weight, we can work out energy, but suppose we know the energy we want either the bullet weight (as here) or the velocity; how do we dope forth the missing number?

FINDING VELOCITY

The square root of (E divided by W times F) equals V (velocity in fps).

You'll note I put part of that inside parentheses, which is necessary to make the answer come out correctly on most pocket calculators. The square root of a given number is that number which, when multiplied by itself, produces the given number. Thus, 2 is the square root of 4, 4 is the square root of 16, and so on. It is possible to work out a square root via pencil and paper, but it's neither easy nor simple. A ten-buck calculator will produce the square root at the touch of a key, provided it has a key with the little square root sign: $\sqrt{}$.

In the recent example, we wanted to know the velocity that produces 2914 fpe with a 165-grain bullet. Let's run that one through the procedure:

$$(2914 \div 165 \times 450,240) = 7,951,511.273$$

$$\sqrt{7,951,511.273} = 2819.842420 \text{ [we round that to 2820]}$$

If we just punch in: $\sqrt{2914 \div 165 \times 450,240}$, without the parenthesis, we get the rather improbable figure of 147,300.7321 fps as our velocity. If, on the other hand, we punch in: $\sqrt{(2914 \div 165 \times 450,240)}$, we get 2820 fps, rounded off.

The difficulty stems from the fact that, without the parentheses, the calculator takes the square root of the first

number - 2914 - instead of finding the square root of the series, as we wanted it to. Not all calculators boast parentheses or brackets. You can still work this on one that doesn't, provided it does have a square root function: Just work out the series to arrive at its answer, then record that on a piece of scratch paper or punch it into the memory (which even the simple calculators usually have, these days) and then take the square root of it. It's just that you need the paren's to do it all in one fell swoop.

FINDING BULLET WEIGHT

If you know the velocity and the desired energy, finding the bullet weight that makes it all come out is done this way:

$$E \div (V^2 \div F) = W$$

Once again, we have to use the parentheses to make it come out if it's all entered as a lump. Lacking parentheses keys, we merely have to divide velocity-squared by 450,-240, recording that figure and dividing the desired amount of fpe (E) by it.

Let's try an example with that. Given a velocity of 3128 fps, what bullet weight will deliver 2241 fpe? Let's assume we have no parentheses keys and do it the hard way:

$$3128 \times 3128 = 9,784,384 \text{ which,}$$

$$\div 450,240 = 21.73148543$$

$$2241 \div 21.73148543 = 103.1222650 \text{ grains}$$

(round it to 103).

If we don't round the bullet weight and run that plus a velocity of 3128 fps through our original equation for finding energy, we get 2240.999999 fpe, which I regard as sufficiently close for government work.

BULLET MOMENTUM

The fast-growing sport of metallic silhouette shooting puts emphasis upon all-out knockdown power, which is needed for toppling the two-hundred-meter rams off their perch.

Momentum does not put as much premium upon velocity as does the figure for kinetic energy and, as a result, the heavier bullets come out looking better. The basic procedure for determining momentum is to multiply the velocity times the weight (in fps and grains, of course) and then divide the product of that by 225,200.

Let's find the momentum of a 158-grain bullet going 1250 fps:

$$1250 \times 158 = 197,500 \div 225,200 = .876998224$$

(call it .877, hmm?).

Using the procedures just reviewed, it's a simple matter to find that a 305-grain bullet at 900 fps and a 76-grain bullet a 1800 fps both deliver about 548 fpe. The respective figures for momentum would be 1.22 and .067 or so.

You're right: the 225,200 sounds like half of our familiar Foom-Factor and one can't help wondering if it shouldn't really be 225,120 instead.

A MATTER OF GRAVITY

Earlier, it was mentioned that the usual physics textbook figure of 32.16 fpsps for the force of gravity (abbreviated G) is subject to slight modification in some circles. There are at least three other such variations:

International Standards currently assign a value of 32.1740 fpsps for G, based upon sea-level standard at 45° latitude.

Standard Meteorological Conditions — Standard Metro, for short — assumes G to be 32.1522.

The International Civil Aviation Organization (ICAO) gives 32.1741 fpsps as the value for G.

It is a simple matter to work up a specialized Foom-Factor for any of these G values, simply by doubling G and multiplying each times 7000. That gives us these alternatives:

International Standard	450,436
Standard Metro	450,130.8
ICAO	450,437.4

Just how much difference does it make if you use a figure for F, based upon these assorted values for G? Let's find out, carrying to as many decimals as the calculator feels inclined to supply. Let's assume a 180-grain bullet going 2700 fps:

$$F = 450,240 \dots 2914.445629 \text{ fpe [Physics textbook]}$$

$$F = 450,436 \dots 2913.177454 \text{ [Int'l. Std.]}$$

$$F = 450,130.8 \dots 2915.152663 \text{ [Std. Metro]}$$

$$F = 450,437.4 \dots 2913.168400 \text{ [ICAO]}$$

It doesn't make an *awful* lot of difference, does it? Personally, I plan to keep on using 32.16 for G, primarily because I already have that one memorized. If you prefer to use one of the other three, by my guest, Edgar!

VOLUME AND DENSITY (OR SPECIFIC GRAVITY)

When doing up *Gun Digest Book of Autoloading Pistols*, I worked up and included a chart showing all of the metallic elements with their symbol, atomic number, density (often termed specific gravity) and melting points in both Celsius and Fahrenheit scales. While I regard it highly unlikely that anyone is apt to cast bullets out of thallium, for example, its density is slightly higher than lead and its melting point a bit lower. The general body of information seems handy enough to warrant its inclusion here.

Let it be noted that figures for both melting points and density tend to vary, depending upon the source you consult. The figures quoted here are as given in a periodic chart of the elements that appears on page 462, next to the listing for elements in *The Random House Dictionary of the English Language*. It lists the melting points in degrees Celsius and I converted those to Fahrenheit by the equation:

$$\text{Celsius} \times 1.8 + 32 = \text{Fahrenheit}$$

$$\text{Fahrenheit} - 32 \times .5555(\dots) = \text{Celsius}$$

The corresponding equation for F to C is included for your convenience.

PROPERTIES OF THE METALLIC ELEMENTS

Element	Chemical Symbol	Atomic Number	Melting Point °C	Melting Point °F	Density (Specific Gravity)
Aluminum	Al	13	660	1220	2.70
Antimony	Sb	51	630.5	1166.9	6.62
Arsenic	As	33	817	1502.6	5.72
Barium	Ba	56	714	1317.2	3.5
Beryllium	Be	4	1277	2330.6	1.85
Bismuth	Bi	83	271.3	520.3	9.8
Cadmium	Cd	48	320.9	609.6	8.65
Calcium	Ca	20	838	1504.4	1.55
Cerium	Ce	58	795	1463	6.67
Chromium	Cr	24	1875	3407	7.19
Cobalt	Co	27	1495	2723	8.9
Copper	Cu	28	1087	1988.6	8.96
Gallium	Ga	31	29.8	85.6	5.91
Germanium	Ge	32	937.4	1719.3	5.32
Gold	Au	79	1063	1945.4	19.3
Iridium	Ir	77	2454	4449.2	22.5
Iron	Fe	26	1536	2796.8	7.86
Lanthanum	La	57	920	1688	6.17
Lead	Pb	82	327.4	621.3	11.4
Lithium	Li	3	108.5	227.3	0.53
Magnesium	Mg	12	650	1202	1.74
Manganese	Mn	25	1345	2453	7.43
Mercury	Hg	80	-38.4	-37.1	13.6
Molybdenum	Mo	42	2610	4730	10.2
Neodymium	Nd	60	1024	1875.2	7.00
Nickel	Ni	28	1453	2647.4	8.9
Niobium	Nb	41	2415	4379	8.4
Osmium	Os	76	2700	4892	22.6
Palladium	Pd	46	1552	2825.6	12.0
Platinum	Pt	78	1769	3216.2	21.4
Potassium	K	19	63.7	146.7	0.86
Praesodymium	Pr	59	935	1715	6.77
Rhodium	Rh	45	1966	3570.8	12.4
Rubidium	Rb	37	38.9	102	1.53
Ruthenium	Ru	44	2500	4532	12.2
Samarium	Sm	62	1072	1961.6	7.54
Scandium	Sc	21	1539	2802.2	3.0
Selenium	Se	34	217	422.6	4.79
Silver	Ag	47	960.8	1761.4	10.5
Sodium	Na	11	97.8	208	0.97
Strontium	Sr	38	768	1414.4	2.6
Tantalum	Ta	73	2996	5424.8	16.6
Tellurium	Te	52	449.5	841.1	6.24
Thallium	Tl	81	303	577.4	11.85
Thorium	Th	90	1750	3182	11.7
Tin	Sn	50	231.9	449.4	7.3
Titanium	Ti	22	1668	3034.4	4.51
Tungsten (see Wolfram)					
Uranium	U	92	1132	2069.6	19.07
Vanadium	V	23	1900	3452	6.1
Wolfram	W	74	3410	6170	19.3
Ytterbium	Yb	70	824	1515.2	6.98
Yttrium	Y	39	1509	2748.2	4.47
Zinc	Zn	30	419.5	787.1	7.14
Zirconium	Zr	40	1852	3365.6	6.49

DENSITY OF WATER

It is usually stated that water weighs "about 62.5 pounds" per cubic foot. On page 252 of the auto pistol book just mentioned (commonly termed BAP), I attacked the problem via the route that the metric system of weights and measures is based upon the fact that one cubic centimeter (cc), aka milliliter (ml) of pure water, at a temperature of 4°C/39.2°F weighs precisely one gram, *by definition*. It is at that exact temperature that water achieves its greatest density.

The relevant conversion factors are:

$$\text{cubic centimeters} \times .0610234 = \text{cubic inches}$$

$$\text{cubic inches} \times 16.387156 = \text{cubic centimeters}$$

$$\text{grams} \times 15.43236073 = \text{grains}$$

$$\text{grains} \times .0647989 = \text{grams}$$

With all that assumed, it was a fairly simple matter to determine that one cubic inch of water weighs 16.387156 grams/252.8924908 grains/.578039978-ounce/.036127498-pound. Taking the last figure times the number of cubic inches in one cubic foot (1728), the weight of one cubic foot of water appears to be right about 62.42831773 pounds — *when at a temperature of 4°C/39.2°F and sea-level altitude*. At any other temperature, in either direction from there, it will be some amount lighter. The quoted figure is the most that a cubic foot of water can possibly weigh.

DENSITY OF LEAD

I have it on the word of Homer S. Powley that one cubic inch of lead, in its pure state, weighs exactly 2870 grains. I'm inclined to accept that until persuaded otherwise. By simple multiplication, that gives us 708.48 pounds as the weight of one cubic foot of lead. Since density/specific gravity of solids is based upon their weight in comparison to an equal volume of water, it is easy to go on and obtain 11.34869601 as the refined figure for the density of lead. You'll note the accompanying chart shows it as 11.4 and I mention all this mainly to introduce a grain or three of skeptical salt into your attitude toward such data.

ROUND LEAD BALLS

On page 764 of the 1984 edition of *The World Almanac*, under miscellaneous measures, there's an entry concerning *Gauge* as the measure of shotgun bore diameter. It notes the number originally referred to the number of lead balls of the gun-barrel diameter that weighed one pound. Thus, sixteen balls the bore diameter of a 16-gauge weighed one pound, or an even ounce apiece. Today, an international agreement assigns millimeter measures to each gauge, e.g.:

Gauge	Bore diameter in mm
6	23.34
10	19.67
12	18.52
14	17.60
16	16.81
20	15.90

Those are the only ones they list, giving the dimension for the unlikely 6-gauge and exotic 14-gauge, but omitting the 28-gauge and 8-gauge, either of which is at least a trifle commoner than the 6- and 14-gauge.

Let's crank in our conversion factors for inches/millimeters:

$$\text{inches} \times 25.40005 = \text{millimeters}$$

$$\text{millimeters} \times .03937 = \text{inches}$$

On that basis, the internationally accepted bore diameter for a 12-gauge (18.52mm) works out to .729132400-inch. I note all this, here at the start, to avoid leading anyone astray. If we accept that lead in pure state weighs 2870 grains per cubic inch (as I'm still inclined to do), then the precise diameter of twelve balls of equal size weighing exactly one pound (avoirdupois) would be .729477820-inch; larger than international standards by a matter of some .00034542-inch. A trifling matter, you say? Many a machinist would argue with you vehemently on the matter. Three-ten-thousandths-inch is no picayune affair when working metal to any pretense of precision.

So how do we arrive at our figure for the diameter of a 12-gauge shotgun bore? Thought you'd never ask!

The cube root of 7000, divided by the gauge-number (12), divided by 1502.728486, equals the diameter in inches. The 7000 is the number of grains in one pound. The final figure is .523598776 [pi divided by 6] times 2870 [the number of grains a cubic inch of lead weighs]. As in earlier examples, punch it in so you're taking the cube root of all the other figures enclosed by parentheses. Like so:

$$3 \sqrt{(7000 \div 12 \div 1502.728486)} = .729477820\text{-inch}$$

Every now and again some unthinking writer will refer to a ".410-gauge shotgun." Armed with the equation just given and dropping a few decimals, it's a simple matter to determine that a 1-gauge shotgun would have a bore diameter of 1.67 inches and a ".410-gauge" would have a bore of just a wee tad under 2¼ inches.

The slender shotguns are more correctly termed .410-bore, since they have a bore diameter (presumably) of .410-inch. If you've ever wondered what that would be in terms of the gauge designation, I can confide it would be a 67.587433-gauge.

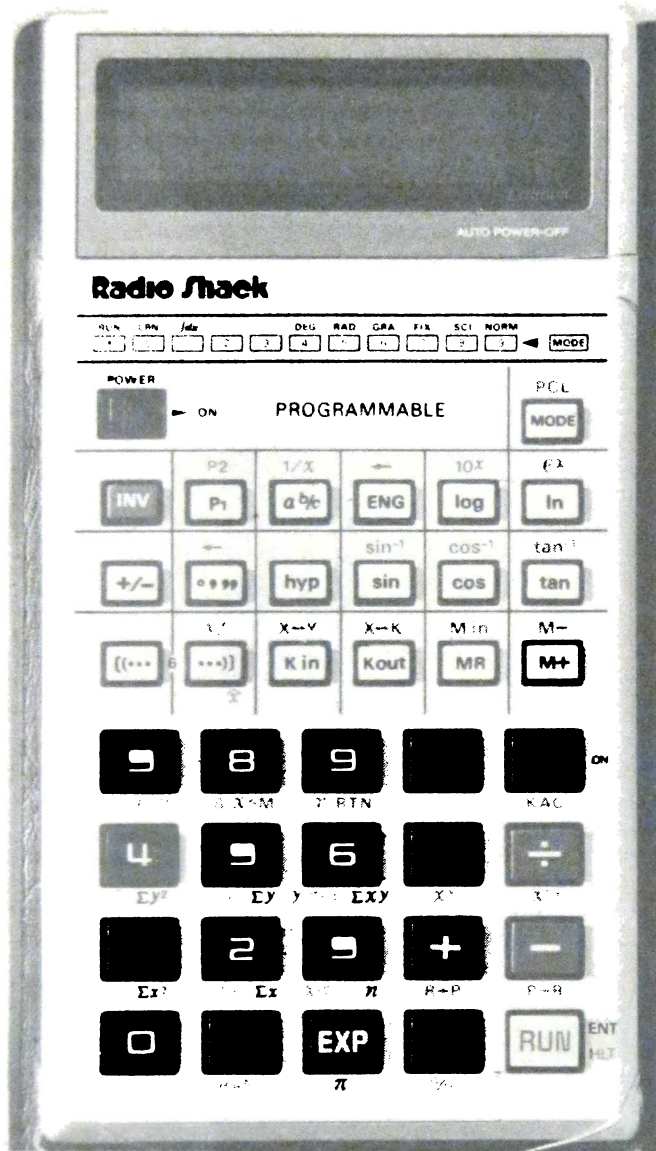
If you'd care to compare the internationally accepted bore sizes to those obtained by the renegade-but-right approach given here, the other ones run:

Gauge	International	Calculated	Variance (Calc.)
6	.9188958	.919084461	+.00018866
10	.7744079	.775185857	+.000777957
14	.692912	.692941378	+.000029378
16	.6618097	.662774584	+.000964884
20	.625983	.615265422	-.010717578

If you can discern a pattern in all that, you're a better man than I am, Gunga Din!

PI IN THE SKY

The ratio between the diameter and circumference of a



Retailing for about \$34, the Radio Shack Model EC-4004 is ostensibly quite capable, but handicapped by a maddeningly inadequate op-manual. I can't recommend this one.

circle — usually termed pi (π) — is an irrational number that just plain never quite comes out even. People with the proper sort of sophisticated equipment and bounteous amounts of time to futz about with it have worked the value of pi out to something like 2500 decimal places and no sign of an end in sight. In one of Robert Anson Heinlein's science fiction stories — I forget just which one, offhand — he cited the value of pi to the first twenty-nine decimals as:

3.14159265358979323846264338327

I included that in ABC/R2 and duly transplant it here. I think it's always nice to have these thing where one can look up, don't you? If you punch the pi-key on a reasonably decent pocket calculator, it will feed back 3.141592654 as the value for it. Down in Tennessee, where the congresspeople sometimes become restive on long summer

days, they once elected to make pi equal to 3-1/7 by legislative decree, but it didn't work out overly well and they eventually abandoned their crusade. I thought of that, a page or two back, when chronicling the internationally agreed-upon shotgun bore dimensions. So it goes.

If we divide pi by 6, we arrive at further useful figure of .523598776 or so. To find the cubic contents (volume) of a sphere, multiply the cube of its diameter by (pi/6).

What can we expect a round lead ball to weigh, if its diameter is .358-inch?

$$.358 \times .358 \times .358 = .045882712 \text{ [diameter cubed]}$$

$$.045882712 \times .523598776 = .024024132 \text{ cubic inch}$$

$$.024024132 \times 2870 = 68.94925832 \text{ grains}$$

CIRCLES & SPHERES

Once in a while, it may be desirable to cipher forth the diameter of a circle that has precisely yay-much area. For example, a circle has an area of one square inch; what's its diameter?

Since radius-squared times pi gives the area, the equation, turned inside-out, reads: area divided by pi equals the square root of the radius. Put more manageably:

$$(\sqrt{A \div \pi}) \times 2 = D$$

Thus, it becomes fairly simple to punch keys and find out that a one-square-inch circle has a diameter of 1.128379167 inches, approximately.

Diameter-cubed times pi-over-6 (.523598776) equals the volume of a sphere. If we know the volume and want the corresponding diameter, it goes:

$$3 \sqrt{(V \div .523598776)} = D$$

Working that for a volume of one cubic inch, we get a diameter of 1.240700982 inches and, cross-checking that, we find its volume turns out to be 1.000000001 cubic inches. The volume of a sphere having a diameter of 1.240700981 inches comes back as .999999998-cubic-inch. So it goes. The respective weights, in pure lead — according to Powley — would be 2870.000003 grains and 2869.999994 grains; a variance of .000009-grain, which I tend to regard as rather ephemeral.

CUBE ROOTS & OTHERS

Some calculators — such as the Sharp Model EL-5100 used in working up the present discussion — have a cube root key marked $\sqrt[3]{}$. On the EL-5100, it's the second function, above the key marked x^{-1} and you bring it into action by pressing the key marked 2nd F, then the key marked x^{-1} . Then you enter the number for which you wish to find the cube root, press the = key and the answer appears on the display.

Other calculators merely have a key marked Y^x which can be used to raise a number to any desired power or to determine the root of the number to any power. Let's say you wish to cube .596025021 (raise it to the third power). Enter the number on the display, press the Y^x key, followed by 3, then the = key and .2117354 will appear on the display: the cube of the original number.

Now, if we wish to get the cube root of that number, press the $\sqrt[n]{}$ key again, followed by the decimal point and a string of 3s, then press the $=$ key and the display will read 596025021 again. Note that, for the $\sqrt[n]{}$, we entered the reciprocal of the exponent; 3 in this example. The reciprocal of a number is 1 divided by that number: $1 \div 3 = .333333(\dots)$, and so on.

Let's try that again, with a working number that comes out even. Enter 27 on the display, press $\sqrt[n]{}$, press the decimal followed by a dozen 3s, then the $=$ key. The display will read 3.00($\dots$), the cube root of 27. Now press $\sqrt[n]{}$, then 3, then $=$ and the display will read 27.000($\dots$) again, having cubed the 3 back to the original number.

Want to raise 48 to the fourth power? Key 48 onto the display, followed by $\sqrt[n]{}$, then 4 and $=$. The display will read 5,308,416. Now press $\sqrt[n]{}$, then .25, then $=$ and the display goes back to 48 again. The .25 was the reciprocal of 4, the exponent.

Finding roots to assorted powers can be done on the Sharp Model EL-5100 even more simply by use of the $\sqrt[n]{}$ key, which is the 2nd Function entry above the $\sqrt[n]{}$ key. A convenience of going this route is that it simplifies use of decimals in the exponent. Merely key in the desired exponent (power of the root), then hit the 2nd F key, then the $\sqrt[n]{}$ key, followed by the number for which you wish to determine the root. As an example, to find the root of 65.536 to the fourth power, punch:

4; 2nd F; $\sqrt[n]{}$; 65.536; $=$ 16.000($\dots$), the answer

The reciprocal for any number can be found by keying in that number, followed by the x^{-1} key, then the $=$ key.

I mention all that because it seems potentially handy to have such capabilities on tap, but the instruction booklets supplied with calculators rarely, if ever, spell it out.

SKELETON TRIG

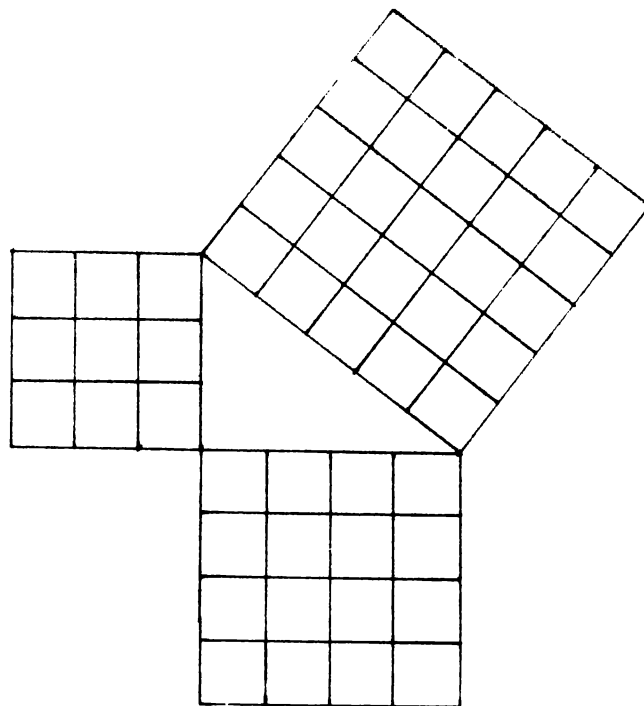
Most of the more pretentious calculators will deal you out the figures for sines, cosines and tangents (abbreviated sin, cos and tan, respectively) at the tickle of a key. The abbreviations, by the way, are written without a period at the end. These are functions in trigonometry, potentially useful in specialized situations, if you know what they are and what they do.

If you're proficient in trigonometry, you're quite welcome to skip along to the next heading. I'm not overly gifted along such lines and I propose to inlay some of the basic-basics of plane trigonometry at this point.

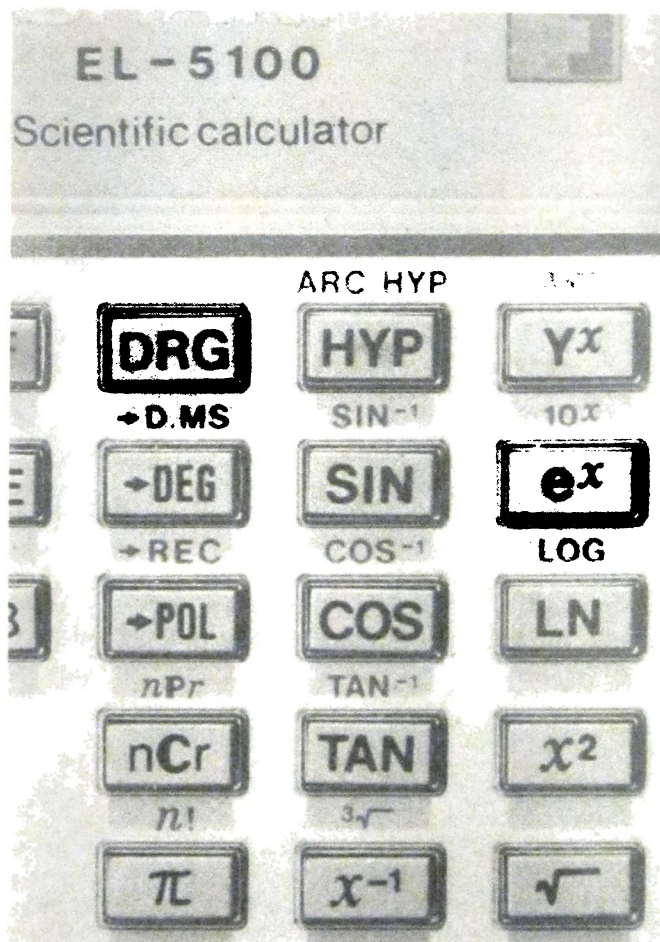
Trigonometry is the study of the sides and angles of triangles, commonly right triangles. A right triangle is one that has one corner measuring exactly 90° . The sum of the angles of the other two corners (apices, the plural of apex) is always equal to 90° also, since the combined sum of the three angles of a triangle always adds up to 180° .

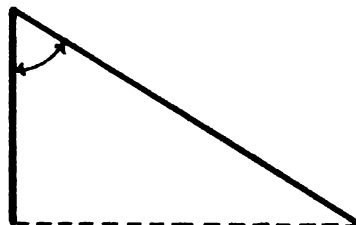
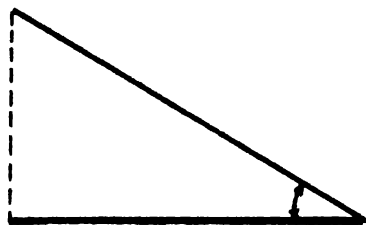
The longest side of a right triangle always falls directly opposite the 90° angle and it is called the *hypotenuse*. The two sides adjacent to the 90° angle are always shorter than the hypotenuse. An *acute angle* is an angle of less than 90° . The angular spread to the two acute angles of a right triangle dictates a fixed ratio or relationship between the length of the two shorter sides, and of the hypotenuse.

If you construct a right triangle with the shortest side three inches in length and the next-shortest side four inches

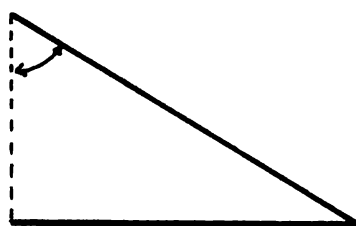
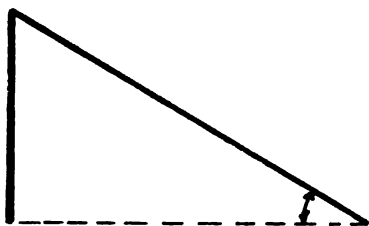


Above: The 3-4-5 triangle illustrating the Pythagorean theorem. (Opposite page) The basics of First Quadrant trigonometry. (Below) The sin, cos and tan keys on the Sharp EL-5100, topped by arcsine ($\sin^{-1}$), as discussed. Press 2nd F key to use.

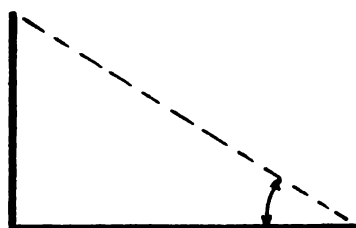
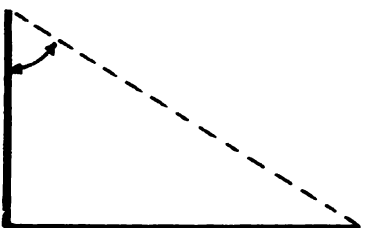




COSINE: The length of the short side adjacent to the angle, divided by the length of the hypotenuse; always less than a whole number.
SECANT: Length of the hypotenuse, divided by length of the short adjacent side; always greater than a whole number. The cosine and secant of a given angle are mutually reciprocal.



SINE: The length of the side opposite the acute angle, divided by the length of the hypotenuse.



TANGENT: The length of the side opposite the acute angle, divided by the length of the adjacent shorter side. Tan 45 is 1.000 since the two sides would be equal. Tangents of angles less than 45 degrees are decimals less than one; of angles greater than 45, numbers larger than one.

long, the hypotenuse will be five inches long. That is in accord with a discovery made by the considerably late Pythagoras (c.582-c.500 BC) that the square of the two short sides of a right triangle equal the square of the hypotenuse. Square three to get nine; square four to get sixteen. Sixteen and nine are twenty-five, the square of the five-inch hypotenuse. It works, no matter what unit of length you use: from Angstrom units to light-years and beyond in either direction.

If we construct a right triangle to those proportions, it's obvious the shortest (three-inch) side is sixty percent the length of the hypotenuse and the next-longest side is eighty percent of its length.

In this example, we know the proportional ratio of the length of the three sides because we started out with that. What we'd like to find out is the angular spread of the two acute angles. For the sweet sake of simplicity, we will be

working in decimal portions of degrees, rather than in degrees/minutes/seconds. Thus, thirty degrees and thirty minutes become an arbitrary 30.5° and so on.

With that accepted, it can be stated that the angle between the shortest (three-inch) side and the hypotenuse spans 53.13010235° and the angle between the next-shortest (four-inch) side and the hypotenuse amounts to 36.86989765°, fairly close. Add the two and you get 90.000(...), along with a shored-up faith in the fitness of it all.

With the example at hand, let's peg down a few of the trig terms in their fixed relationship to things.

Cosine: From either acute angle of a right triangle, this is the length of the adjacent shorter side, divided by the length of the hypotenuse. The cosine will always be a decimal smaller than one, and the cosine of a 90° angle is zero. The cosine of our improbably precise angle of

36.86989765" is .800(...) and zeroes forever. You'll recall the four-inch side is eighty percent as long as the five-inch hypotenuse, right?

Moving to the other acute angle, the cosine of 53.13010235 is .600(...) and three inches certainly is sixty percent of five inches. So much for cosines.

Sine: In a right triangle, this is the ratio of the side opposite an acute angle to the hypotenuse. The sine of our pointiest angle (36.86989765) is .600(...) and, as we've observed, three inches is sixty percent of five inches. The sine of the fatter angle is .800(...) and, once again, it works out.

Tangent: This is the ratio of the length of the side opposite an acute angle to the shorter of the other two sides (that is, not the hypotenuse). Tangent of the pointy angle is .750(...) and the three-inch side certainly is seventy-five percent the length of the four-inch side. Tangent of the fatter angle is 1.333(...) and four inches is that much bigger than three inches, for sure.

Secant: The ratio of the length of the hypotenuse of a right triangle to the side adjacent to either acute angle. The secant is the reciprocal of the cosine.

Most calculators do not have a key for instant and painless determination of the secant because it's a simple matter to determine the cosine and whack forth the reciprocal of that to arrive at the secant. The cosine will always be a decimal smaller than one and the secant will always be greater than unity because the hypotenuse is the longest of the three sides. Merely punch forth the appropriate cosine, then divide one by that and you get the secant.

Example: The cosine of the pointy angle, 36.86989765, is .8 and one divided by .8 is 1.25: the ratio between the five-inch length of the hypotenuse and the longest, four-inch side.

So there, *amigas y amigos*, you have the primal, bed-rock basics of trigonometry in terms of its interlocking relationships. I selected a triangle of proportions to illustrate it all in fairly solid numbers but the same approach works with right triangles of any proportions whatsoever. Just for fun, you might wish to try it all out on a triangle with acute angles of 30° and 60° — why not?

For the record, I tried working out the angular measurements of the two acute angles of the Pythagorean triangle by trial and error, using scratch paper to record the trial shots, and I came fairly close. Then — mindful of my ongoing philosophy ("If you can't be smart, be crafty!") — I punched the 2nd F key, then the COS⁻¹ that rides above the COS key, followed by .8 and the display came up with the precise figure of 36.86989765, shazam! Did the same thing for .6 and got the other matching angle.

Please don't write to ask exactly what is the practical application for all this folderol. Accept it as my private rebellion against all the erudite stuffed shirts who have authored math books and especially books purporting to spell out the mysteries of trigonometry in simple, easy-to-grasp format. Nothing I've encountered to date makes much sense to a person who doesn't know what the guy is talking about in the first place.

It's a private conceit of mine that, if I can just get my own mind around something, I can go on to explain it so that just about anyone can grasp it more easily than I did. Having slogged through the foregoing, see if you agree and, if you don't, let me know what baffled you, please?

In the meantime, I've long yearned for an "ABCs of Trigonometry" that I could have available for consultation in time of need. I've cranked all this into the work at hand so as to have it at my fingertips in the future. Put quite candidly, I refer to these books myself, at least as often as any of the other readers do. Now, do you understand why I threw all this in?

The 2nd F toppings of the SIN, COS and TAN keys on the Sharp EL-5100 are SIN⁻¹, COS⁻¹ and TAN⁻¹, respectively. If you key them first, then the decimal figure that represents the ratio, they will feed you back the angular spread in decimal notation corresponding to that ratio. There is another key that will turn that into degrees, minutes and seconds, if that happens to cozen your fancy any.

The instruction booklet that comes with the Sharp EL-5100 is depressingly vague about a lot of these capabilities and that applies to the op-manuals that accompany any of the other calculators that I've encountered to the present, specifically including the Radio Shack EC-4004.

Math sharks among the readership are welcome to rejoin the rest of us, now.

MINUTE OF ANGLE (MOA)

A circle of any size can be divided into 360 degrees of angle. Each degree breaks down into sixty equal minutes of angle and each minute into sixty equal seconds.

Shooters — particularly rifle shooters — often discuss group-spread in terms of minutes of angle, customarily abbreviated as MOA. One MOA at one hundred yards is roughly one inch in spread; actually, a trifle larger than that. Just how much larger? It's not terribly hard to work it out, given a little thought. The distance of one hundred yards constitutes the radius of the imaginary circle and its full diameter would be two hundred yards, or six hundred feet, or 7200 inches. Multiplying 7200 inches times pi, we get 22,619.46711 inches as the circumference of the circle. There are (360x60) 21,600 MOA in a circle so it's a simple matter of dividing the circumference (22,619.46711 inches) by 21,600 to get the figure of 1.047197551 inches as our fairly-close value for one MOA at that distance.

As has quite recently been pointed out to me, it can be worked out through trigonometry, equally as well. Envision a pair of extremely thin right triangles, long side to long side, a hypotenuse top and bottom and the short sides each equal to one-half MOA. Since one MOA equals 1/60-degree or .01666(...) -degree, we need to find the tangent of an angle half that spread, or tan .008333(...) and that turns out to be .000145444, representing one-half MOA at a distance of one inch.

If we take .000145444 x 3600 (inches in one hundred yards) times 2, we get 1.047197559 inches as our value for one MOA at one hundred yards. That disagrees with our first answer by .000000008-inch, but not many musketeers measure their groups with such berserk precision, anyway.

A meter is 39.37 inches so we can go on to say that one MOA at a distance of one meter is .011452269 inches or, for that matter, .290888202mm. Thus, at a distance of fifty meters, one MOA would be 14.54441009mm or .572613443-inch, give or take the odd verst. The *verst*, if you've wondered, is a Russian unit of length, used in lieu of miles, kilometers or the like.

CONVERSION FACTORS & OTHER HANDY NUMBERS

Every now and again, it's convenient to transmute peaches into nectarines (thought I was going to say apples into oranges, didn't you?) and it's a source of comfort to have the specific factors ready at hand for the chore. From time to time, faced with the urgent need to turn furlongs into poods, or hectares into dithyrambs, I consult my previously published works, only to find that I neglected those vital numbers. This time, I'll try to crank in everything [reasonable!!!] in sight so that, in the future, faced with comparable dilemmas (dilemmae?) I can reach for the copy of ABC/R3 with icy certainty I'll find what I need therein. I hope you do, too.

TEMPERATURE

Conversion procedures between °C and °F were given earlier, but we'll repeat them here, for the sake of including °K, as well. The K stands for Kelvin and I'll refrain from repeating the gaucherie about President Coolidge that appeared in BAP.

Theoretically, absolute zero is as cold as anything can possibly get and that frigid lower limit is tentatively pegged at -273.15°C or -459.67°F. Absolute zero coincides with 0° Kelvin and from there, it goes up by degrees Celsius. Thus, 273.15°K is equal to 0°C and equally so to +32°F:

Celsius + 273.15 = Kelvin

Kelvin - 273.15 = Celsius

Fahrenheit - 32 x .5555(...) = Celsius

Celsius x 1.8 + 32 = Fahrenheit

To convert Fahrenheit to Kelvin or vice versa, first convert F to C, then to K as given, or K to C to F. Note that Celsius is the temperature scale formerly termed Centigrade. The F scale and C scale coincide precisely at -40°.

LENGTH UNITS

millimeters x .03937 = inches

centimeters x .3937 = inches

meters x 39.37 = inches

meters x 3.2808321 = feet

meters x 1.0936109 = yards

inches x 25.40005 = millimeters

inches x 2.540005 = centimeters

inches x .02540005 = meters

feet x .3048007 = meters

yards x .914402 = meters

(statute) miles (5280 feet) x 1.6093419 = kilometers

kilometers x .6213327 = miles (statute)

nautical mile = 6080.2 feet (U.S.)/2026.7333(...) yards

nautical mile = 6080 feet (Great Britain)/2026.666(...) yards

international mile = 6076.103 feet/1.852 km/

2025.367667 yards

Swedish mile = 10 km/6.213327 statute miles/

10,935.45552 yards

angstrom or Angstrom unit = 1/10,000,000 millimeter

micron = 1/1,000,000 meter or 1/1000mm/.00003937-inch

millimicron = 1/1000-micron/.0000003937-inch/

10 angstroms

nanometer = 1/1,000,000,000 meter

light-second = 186,284 miles

light-year = 5,876,675,958,400 miles

parsec = 3.26 light-years/19,164,483,624,000 miles

furlong = 220 yards/1660 feet/40 rods

rod = 5.5 yards/16.5 feet

verst = .6629 miles/1.066832746 km

VOLUME UNITS

cubic centimeters/milliliters x .061023401 = cubic inches

cubic inches x 16.3871564 = cubic centimeters/milliliters

gallon (U.S.) = 231 cubic inches

British Imperial (BI) gallon = 277.42 cubic inches

fluidounce (U.S.) = 1.804 cubic inches

fluidounce (BI) = 1.7339 cubic inches

cubic yard = 27 cu ft/46,656 cu in./765 cu meters

cubic mile = 5,451,776,000 cubic yards

WEIGHT UNITS

Avoirdupois system:

pound = 16 ounces/256 drams/7000 grains

ounce = 16 drams/437.5 grains

dram = 27.34375 grains

Troy system:

pound = 12 ounces/240 pennyweight/5760 grains

ounce = 20 pennyweight/480 grains

pennyweight = 24 grains

Apothecaries' system:

pound = 12 ounces/5760 grains

ounce = 8 drams/480 grains

dram = 3 scruples/60 grains

scruple = 20 grains

Note: The grain used in all three systems is uniform in weight and equal to .064789-gram.

metric ton = 2204.6224 pounds/1000 kilograms

short ton = 2000 pounds

long ton = 2240 pounds

British stone = 14 pounds

pounds x .4535924 = kilograms

kilograms x 2.2046224 = pounds

grains x 15.43236 = grams

grams x .0647989 = grains

pood = 36.11 pounds

MISCELLANEOUS

miles per hour x 1.4666(...) = feet per second

feet per second x .681818(...) = miles per hour

foot-pounds of energy x .1383 = kilogram-meters

kilogram-meters x 7.233 = foot-pounds

3600 ÷ seconds per mile = mph

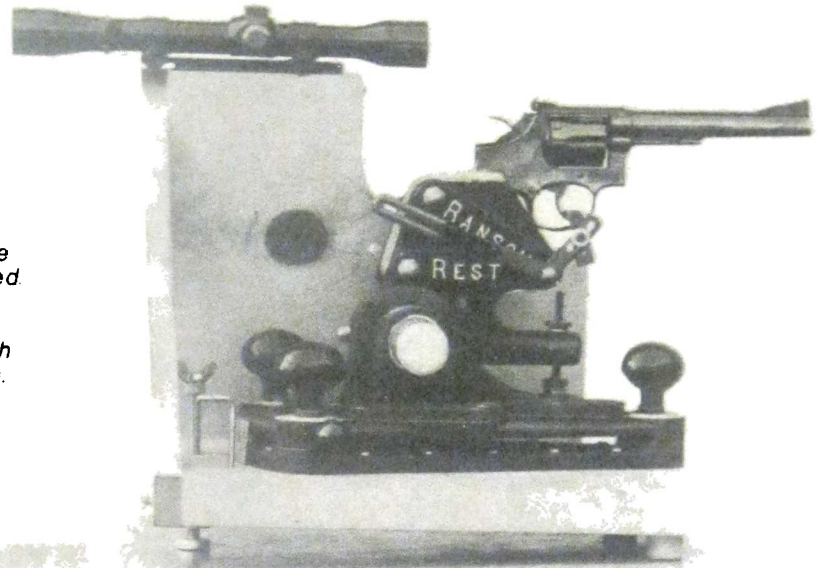
miles per gallon x .4251758 = kilometers per liter

kpl x 2.3519678 = mpg

It's to be hoped that, in the course of all that, there can be found something that will be of some use and application to somebody. There's more that could be included, but you have to tie it off sometime and this seems like an appropriate place.

TESTING & EVALUATING RELOADS

The Robot Pistolero, set up on the portable shooting bench, with an S&W K-32 mounted. The unit is not fastened to the bench, and it moves with each shot, but it's aimed for the next shot by means of the scope, which is in fixed alignment to the bore of the gun.



HOW DO YOU find out exactly how well your reloads perform? It's a pertinent point because, if they don't do as well as factory loads, or better, you've only saved a bit of cash outlay and done so at the sacrifice of group tightness.

Rating reloads for rifles is a pleasantly simple and straightforward matter. All you have to do is fire them off the benchrest and see how clannishly tight the holes cluster together. With a good scope sight, it is a matter of essential simplicity.

When it comes to handgun load-testing, it's another matter, altogether. True, you can test them off the bench,

Methods And Techniques For Comparing Performance In Several Areas

with the gun butt braced against sandbags, but it lacks some of the taut precision of firing rifles in the same manner.

Testing reloads for handguns can be made usefully more objective by mounting a scope sight on the pistol or revolver. It is not possible or practical to do that with all makes and models, but such mounts are available for a surprising number of handguns today. Many of these offer the advantage of requiring no drilled and tapped holes to be made in the gun. Thus, when you don't wish to have a scope bulking up on the topside, it's a simple matter to take it off.

B-Square Company (Box 11281, Ft. Worth, TX 76109) is a prolific producer of no-drill/tap scope mounts for handguns, rifles and shotguns. If they don't have what you need and want right now, stay in touch because it may be added in the near future. Scopes on shotguns? It's not as absurd as it may seem at first thought. They're quite handy for testing slug loads, among other things.

There's quite a neat system for scoping those workhorses of the Remington line — the Model 870 pump and Model 1100 auto — for example. Again, it requires no drilling or tapping and is readily removable. Such mounts are available from B-Square and may be available from Weaver again, now that Omark has taken over the mount and rings segment of the Weaver operation.

A lot of attention has been devoted to approaches for scoping the ubiquitous Colt Model 1911 and its numerous lookalike contemporaries. Some have involved drilling and tapping the upper surfaces of the slide. Those work, given special attention, but adding that much weight to the moving portion of the action imposes the need to maintain a fairly high level of recoil impulse to assure reliable functioning of the action. Then too, when you decide you want the scope off so you can use the holster again, you're left with all those less-than-aesthetic holes in the top of the slide. It's less of a problem if you happen to have a spare slide for the old blaster.

B-Square has a no-drill/tap mount for the M1911 which positions the mount to the receiver, rather than the slide. As an added fillip, it will accept the Aimpoint sight as readily as a scope. Meanwhile, with either device, if a load will function in the unscoped pistol, it will perform just as nicely when the B-Square rig is in place.

The Aimpoint is an interesting concept, with quite a lot of good things going for it. When you turn on the little switch, a highly-visible red dot is superimposed upon the viewed image, utterly free of parallax at any sighting distance. There is no magnification in the basic rig, but a magnifying accessory is available for retrofit installation and removable when not wanted. It is probably the best thing around for the shooter striving to cope with aging eyes, since it puts forth a crisp image in which everything is effortlessly in focus. The little red glowing pip — I think of it as a "glip" — is not readily capable of dotting-in groups of less than one minute of angle (MOA) for the simple reason that it subtends slightly more than one MOA, as viewed. A further minor complexity is that, when mounted on the B-Square system for the Colt M1911, the line of sight rides so high above the axis of the bore that parallax presents a real problem. It can drive tacks, on demand, but it can do so only when painstakingly adjusted for that one given distance. If the target is a little closer or a bit more distant, you need to readjust for pinpoint projectile place-

ment. Well, no one ever said you could have everything, did they now?

The Thompson/Center Contenders, as a category, are eminently amenable to installation of scope sights and nearly all suppliers of mounts and rings offer sets that will do remarkably well on the T/CC. Since some of the cartridges handled by the gun are notably striving, you may need a lot of stubborn determination in the mount, and in the scope. T/C has their own line of sights, dubbed R-P for recoil-proof, and they certainly are, in my own experience.

The best T/CC scope mount I've encountered to the present is the one from SSK Industries (Rte. 1, Della Drive, Bloomington, OH 43910), termed the T'SOB. It will cope with, endure, and chuckle sardonically at the strains imposed by the most gosh-horrible cartridges for which the T/CC has been chambered to the present. Worry about the scope if you like, but the T'SOB mount and rings will stand the gaff.

A further approach to load and firearm testing is the machine rest and the suppliers along that line are but a limited few. We have the B-Square operation, mentioned earlier, with their handy rig that handles the M1911 Colt in single-shot mode, and we have the Ransom Rest, produced by Chuck Ransom out of C' Arco (Box 308, Highland, CA 92346). The Ransom Rest is adaptable to nearly any reasonably popular handgun, ranging in sizes from the S&W Chiefs Special up to the T/C Contender.

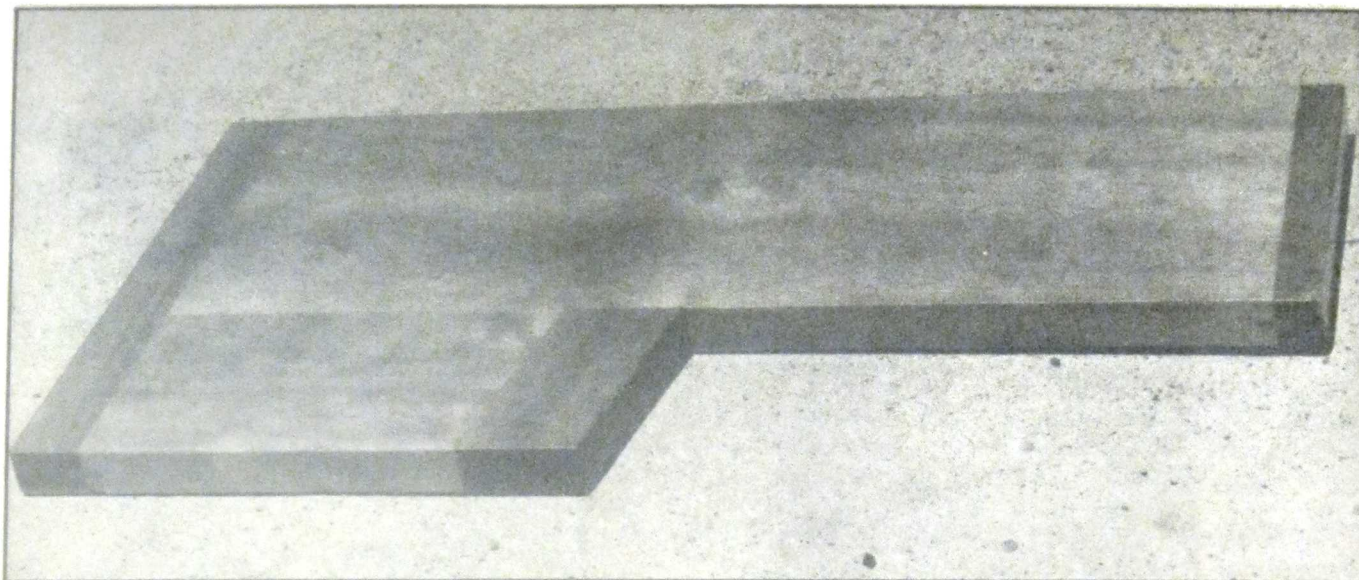
Ideally, the Ransom Rest needs to be anchored to something sufficiently massive and immovable as to resist any displacement of the bore from shot to shot. Given reasonable control and security at the shooting site, you can set up forms and pour a concrete base, with mounting bolts emplaced so as to make it a simple matter to bolt the Ransom Rest in place for the testing session.

If, however, the shooting site is accessible to the faceless public between sessions, you may find that some dingaling has taken it upon himself to batter the bolts about with a sledge hammer since your last visit. Or they may have tested their muscle by trying to smash the concrete base, perhaps successfully.

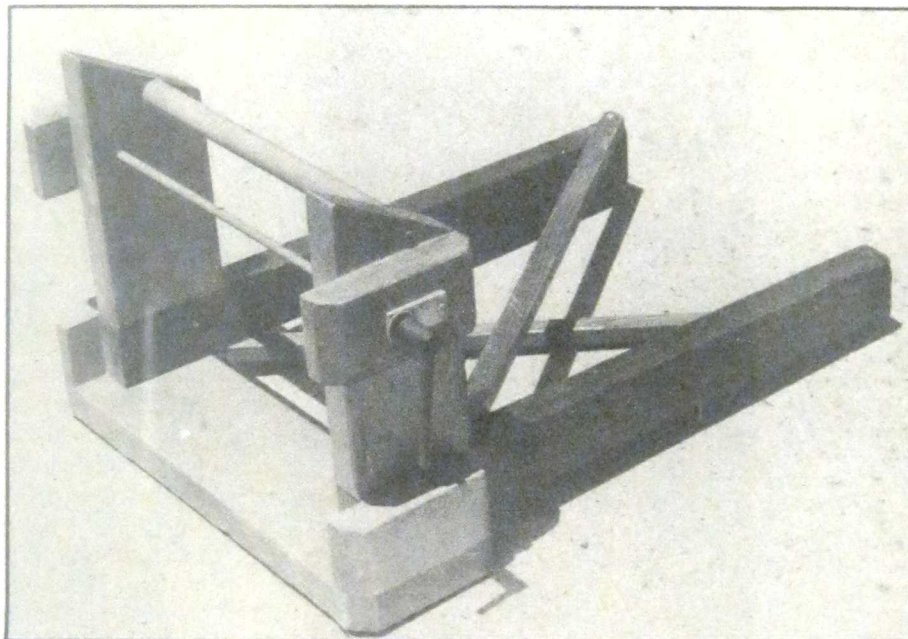
In a situation such as that, it behooves one to try to work up a satisfactory base for the Ransom Rest that can be taken to a place of safe storage between sessions, to be hauled out and set up when needed.

I've come up with at least two possible solutions for such a problem. The first was an idea passed along by a good friend, the late Bill Corson. It involves a base with a projecting length of two-inch plank next to the ground. You anchor it by the simple expedient of emplacing it, then running one of the front wheels of a car or truck onto the length of plank. The resulting apparatus is remarkably solid and it will cope with the recoil of .44 magnums and perhaps even sterner stuff. It has the minor disadvantage of being somewhat bulky and cumbersome. It's a good deal if you drive a pickup truck, less attractive for transporting in a small sedan.

One further note needs entering in regard to the Corson-type Ransom Rest base. You must wear the best earmuff hearing protectors you can get, when using it. The nearby auto fender tends to gather up the muzzle blast and hurl it in your face. Even with the muffs, the concussion is noteworthy when firing heavy stuff and eye protection is equal-



Above: The top of the PSS is constructed of 2-inch planks, held together by aliphatic resin glue. It's 34" long, 17 $\frac{3}{4}$ " wide at the front, 11 $\frac{1}{2}$ " wide at the rear. The angle at the break is 100° and starts 17" from the rear edge. When assembled, the top surface is 27" off the ground. Front support is at right, showing threaded torsion rod and dowel brace beneath it, as well as the leg braces that kill lateral shimmy.



ly vital and mandatory. With auto pistols in the Ransom Rest, you can use the magazine in the customary manner, but you must keep in mind that you're not in the usual position behind the gun and ejected empties can and sometimes do hit you in the face with impressive impact.

A further intriguing aspect of the Corson-type base is the option for extreme long-range shooting, much in the manner of laying artillery pieces. Ransom offers an optional windage base at extra cost. With it, you can tune the bullet placement quite precisely over a considerable range of adjustment. You can also set up a good spotting scope, focused on the target area and observe through it as you press gently on the trigger release. Unlike a scope mounted to the gun, the spotting scope is unaffected by recoil and you can observe the hit and make such corrections as you deem necessary. Potting soup cans at two or three hundred yards is by no means an idle dream with such a setup.

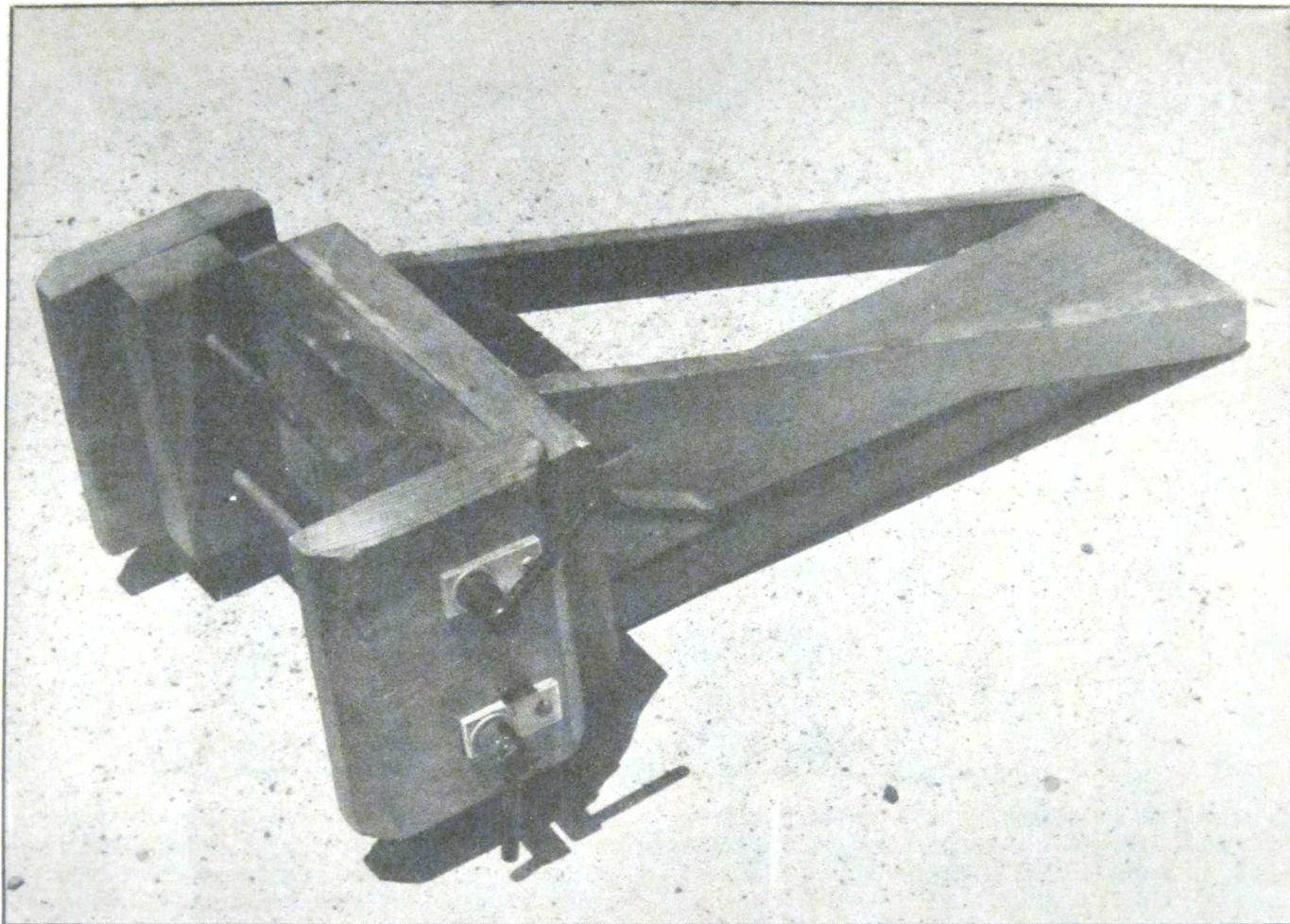
My second approach for a movable base for the Ransom Rest is entirely original, to the best of my knowledge. It is a rather small assembly, built of two-inch planks and suit-

ably braced, with a Weaver scope base secured to the upper edge of the upright by means of four sheet metal screws. Weaver rings hold an old but choice 4X Lyman Perma-Center scope in place. By use of the windage base, the iron sights of the handgun can be harmonized to the crosshairs of the scope and any final compensation can be handled by the adjustment knobs of the scope, itself.

In use, the *Robot Pistolero*, as I call it, is emplaced upon a conventional shooting bench and the scope is employed to aim each shot. Sure, it'll bounce and buck about from impact, but the thing is that you merely go back and zero-in afresh for each subsequent shot, and it works.

Let me qualify that: It works quite well for the more polite and diffident handguns, up through the .38 Special and, marginally, with the .357 magnums. Beyond that, you'd best forget it and opt for the Corson-type base or one of poured concrete.

The shooting site I've used for the past several years is one where I have to portage in my own shooting bench and



Here's the rear support assembly for the PSB. The upper gripping jaws are 11¼" apart and when the two L-nuts are tightened, they force the flanges inward to grip the rear of the top plate. Note the two diagonal braces that nullify front/rear movement of the bench and the screws that anchor glued braces.

stool, along with my target frames and other needfuls. In normal times, it's the trap and skeet range for a nearby gun club, closed on certain days of the week and available to me on those days by arrangement with the club. It affords a safe backstop and fallout area and a place where I can shoot without incurring the condign wrath of vested authorities and that's the entire extent of it. Anything else I need, I have to bring along and set up. That's a comment, not a complaint, as I'm quite happy with the situation.

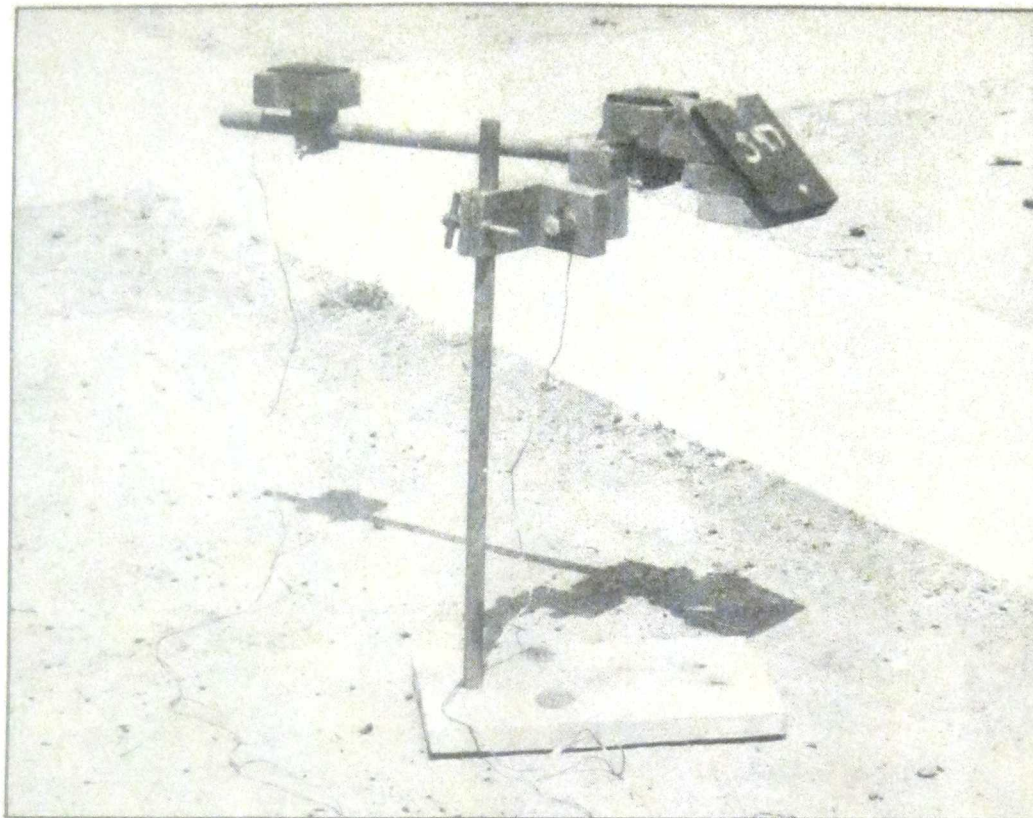
Back in 1978, I mounted one final assault upon the problem of a satisfactory shooting bench that could be assembled or disassembled quickly, capable of being carried handily in a family sedan and, when in use, solid enough so as not to impose any handicap upon the guns and loads being tested. Nearly a decade later, the resulting bench is still bearing up right nobly. Its solidity is attested by the fact that I've fired occasional groups off it that ran to less than one-half MOA. Setting it up or knocking it back down take less than one minute. As an added fillip, it can be assembled for either RH or LH use by simply flipping the upper platform.

The "shortable pooting bench," as I sometimes refer to it, was modest in the cost of its component parts. It develops the torque for its clench-lock holding system by homemade wing nuts acting upon lengths of ¾-16 threaded rod.

Initially, those were sections of flat steel bar stock, drilled and tapped. Later, I replaced those with some simple L-nuts, made up on the lathe, with the crossbars secured by **Stud N' Bearing grade Loctite**. A minor problem is that the available mechanical advantage is amply sufficient for the device to destroy itself, if operated by unskilled hands. I found that out when a business associate borrowed it. I got it back with the supporting hardware buried deeply into the woodwork. Apparently, it was assumed that you had to keep on tightening things until you couldn't tighten it further. That was not quite the way it worked, however. If you make up such an artifact, employ vast discretion in loaning it out.

I'll try to provide photos and perhaps dimensional drawings to give the basic details on the construction. If anyone wishes to build these for the commercial market, I couldn't possibly care less. I've seen a great many designs for portable shooting benches come and go. Some were absolute marvels of strained ingenuity, which could fold and unfold like Japanese *origami*, possibly taking one of your fingers off in the process. Most required specialized hardware and none were remotely as rock-steady as this one. This is the only portable shooting bench I've ever seen that I regard as at least worth the powder to blow it to hell. Cost of materials? I'd be surprised if you didn't get change back from

Vaguely resembling the mythical keebird, the skyscreen stand positions the slits at a 2-foot spacing and has a plate of $\frac{1}{2}$ " steel to guard the vulnerable chipwork. See text for urgent precautions on this! The base, upright and crosspiece are easily knocked down or reassembled.



\$25. Tools needed: a table saw, a hack saw, a bottle of good aliphatic resin glue, preferably Titebond, Wilhold in a pinch or Elmer's as dead-last choice. You may also want a drill press, a 5/16-inch drill bit and a $\frac{3}{8}$ -16 tap for creating the wing nuts. Some pipe clamps will be helpful for gluing up the upper platform and for holding the supporting members while the glue is setting up. Beyond that, you'll need some pieces of two-inch plank, some smaller strips for the bracing, a few sheet metal screws to secure the ends of the braces, along with the glue and perhaps a few cans of spray Varathane for the protective finish when it's all done.

Apart from innate accuracy, evaluation of your reloads can take several other avenues. It is a blissful luxury to have a chronograph, so as to be able to measure the velocity. Once that's done, knowing the bullet weight, you can go on to calculate the foot-pounds of energy. The procedures for that were rather redundantly supplied in the previous chapter.

For the past several usually happy years, I've been using a Tepeco Speed-Meter II chronograph to check velocities of various factory loads and reloads. It employs photoelectric skyscreens and all you need to do is sail the projectile over the slits in them and the net velocity will appear on the readout dial of the box, after a bit of preliminary flickering and muttering to itself.

The unit is powered by batteries and thus can be operated virtually anywhere. If you don't get careless and let the switch be turned on and left unnoticed, the batteries will last a goodly long while. The skyscreens themselves sort of lie in harm's path and great care must be exercised not to let an unwarily directed projectile turn them into an airborne broth of computer chips. My own solution to this particular dilemma has consisted of installing a plate of

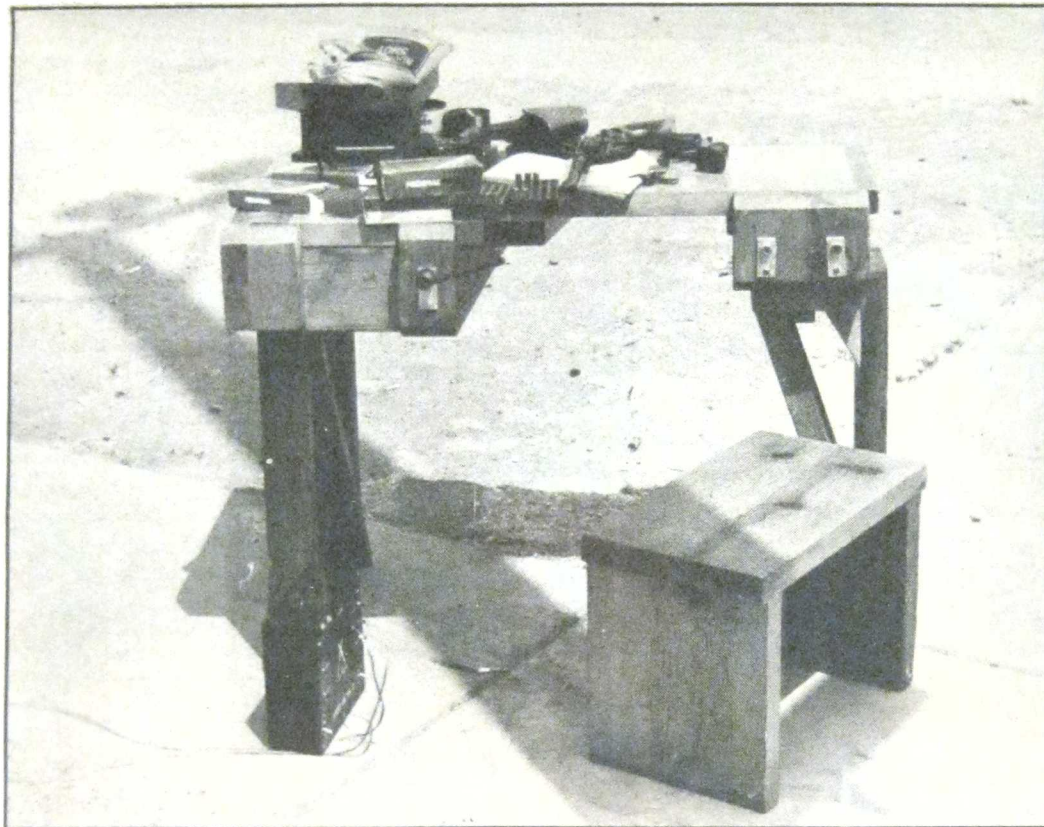
sturdy half-inch steel, at an angle of forty-five degrees to the bullet path, just below the pair of screens. When setting up the screen holding stand, I can take care to make certain that the armor plate will protect the little Bakelite boxes.

That is not the universal cure all, unfortunately. Where I shoot, I have about three miles of absolute nothing in which errant projectiles can come to rest without harming a living creature, with the possible exception of the random rattlesnake. My old friend and frequent collaborator, Claud S. Hamilton, also uses a Speed-Meter II and, plagued by the same problem, I confided my approach to him. He replied that it simply wouldn't work for him. Operating as he does in the Washington, D.C., metropolitan sprawl, the range where he shoots is carefully set up to handle any and all shots fired in a normal manner. However, a forty-five-degree bullet deflector might save the skyscreens in good shape, but it could bring the deflected slug down in residential areas within the fallout perimeters and thus, cannot be used by Hamilton.

A protective baffle could be set up at approximately ninety degrees to the bullet path, still protecting the painfully vulnerable skyscreens. *I do not recommend that.* A solid hit on the shield would be quite apt to volley the projectile right back toward the shooter with a highly hazardous level of velocity.

In the final analysis, if it's impractical to use an angled steel plate, what you have to do is ascertain the probable bullet path with great care before chronographing and take exquisite pains not to pink the screen boxes. You may also wish to keep a spare set of screens on hand against the inevitable emergency.

The Speed-Meter II, apart from the problem of its painfully destructible skyscreens, is an eminently charming and capable little gizmo. A switch permits it to be used with a



The PSB at work, with stool, sandbag rest and the readout box of the Speed-Meter II on the ground. The time for setting up or knocking down the system is perhaps as much as eight minutes and it all rides cozily in a medium-sized auto.

screen spacing of two, five or ten feet. I've never used mine at anything other than the two-foot setting, but routinely pull out my pocket tape measure to verify the accuracy of the spacing when setting it up each time. As with all my testing gear, the chronograph works on knock-down components, quickly and easily set up for use.

If desired, it only takes a bit of patient fiddling-about to get things set up so you can fire at a target and simultaneously clock each shot. By observing through a spotting scope, it becomes possible to keep track of the actual muzzle velocity for each of the holes in the paper and, on retrieving the target, you can add that data to the paper. Under pressure of necessity, I've also made up a neat little knock-down stand for the spotting scope and hope to illustrate same here, space permitting. Compactness was the order of going for design of the shortable pooting bench and space was not allowed for a spotting scope to occupy on it.

You may also wish to test your reloads for penetration capability in comparison to other loads of the same or differing calibers. Within the quite recent past, I had occasion to determine the penetration of the FMJ factory load for the 10mm Auto cartridge in the Bren Ten pistol, as compared to a typical 230-grain FMJ hardball load in the Colt M1911, a 130-grain FMJ from the M1911 in .38 Colt Super and a .44 magnum out of a T/C Contender with Super-14 barrel.

What I did was to select a couple lengths of 2x4 lumber that were somewhat worm-eaten and not much good for any possible construction project. I cut them into uniform lengths of sixteen inches and freighted them to the range, along with a pair of pipe clamps.

On arriving, I took six pieces of the cut 2x4 stock and assembled them into a stack, secured by a pipe clamp at

each end. That gave me about nine inches of fairly solid wood into which I could shoot.

As it turned out, it was a gratifying triumph of visceral-hunch prognostication. The first shot was with the Bren Ten, down through the stack and it penetrated the full distance, bouncing gently to rest on the hard-packed ground beneath it. The .45 hardball got about half-way through the fourth ply and stopped. The .38 Colt Super came to rest in the sixth and last ply. The .44 magnum hardly even *noticed* the wood and drilled on downward, possibly to terrify innocuous souls of Chinese extraction. I wouldn't bet on the last, but I dug for it with a war-surplus trench shovel from the Buick's trunk with no success at all.

Long, long ere this, *amigas y amigos*, I have resolutely given up using steel plates for checking penetrative capabilities of reloads or, for that matter, factory fodder. Sometimes, the bullet blasts on through; other times, the plates more or less stop it and, when that happens, some of the projectile is quite apt to execute a to-the-rear-march and head back at you. I have earned some interesting scars in the process of finding that out. I cordially suggest that you take my word on the matter and refrain from trying it.

In point of observed fact, you can get some pretty adventurous feedback by firing at a hard maple bowling pin with a Colt M1911 in .45 ACP, as I can sincerely attest. I tend to define adventure as something miserable, happening to somebody else. It has been observed that happy nations, such as Switzerland, have hardly any history worth mentioning. Happy experimental ballisticians, in my book, don't have any adventures at all. That can lead to boredom, it's true. The thing is, I can clearly recall times in my own career when I'd've cheerily shelled forth \$100 for a solid minute of clear boredom. If you've been there, you know whereof I speak.

SHOTSHELL RELOADING

It's A Totally Different Ball Game, Requiring Special Equipment And Components, But Interesting, For All That!

It is vital to verify the actual weights of both powder and shot pellets dropped by the shotshell press by use of an accurate reloader's scale. Catch and weigh them only after completion of the entire cycle.





Here are the various shotshells in reasonably common use at present: 2 $\frac{1}{8}$ " 10-gauge; 3 $\frac{1}{2}$ " 10-gauge magnum; 3" 12-gauge magnum; 2 $\frac{3}{4}$ " 12-gauge standard; the one and only current 16-gauge; 3" 20-gauge magnum; 2 $\frac{3}{4}$ " 20-gauge standard; the one and only 28-gauge; the 3" and 2 $\frac{1}{2}$ " loads for the .410 bore. Many other gauges have been tried, and others (including 14-gauge) suggested, but these are the ones we use.

RELOADING FOR the shotgun is a topic so broad in its ramifications and so different in its approaches and considerations, that an entire book could be produced on the subject. Various shotshell reloading books have, in fact, been written and published to date. One of the best I've seen is *Reloading for Shotgunners*, edited by Robert S.L. Anderson, published by DBI Books. Another is *The Handbook of Shotshell Reloading*, by Kenneth W. Cougar and Richard Henderson, published by SKR Industries, Box 1382, San Angelo, TX 76902. Current price of the latter work is \$19.45 a copy to buyers outside Texas; residents of that state add ninety cents sales tax. Price is subject to change, of course.

In addition, recent editions of the Hodgdon Manual have contained sections on shotshell reloading, and shotshell reloading data can be found in the booklets usually distributed without charge by Winchester, Hercules and Du Pont. Sometimes, you'll find load data printed on the bags or other containers in which plastic wad columns are supplied.

Presses for reloading shotshells vary considerably as to cost and sophistication. With no present-day exception of

which I'm aware, shotshell reloading requires a press specifically designed for that purpose. It probably isn't possible and certainly isn't especially practical to reload shotshells on equipment nominally intended for reloading cartridges for handgun or rifle use.*

Shotshell reloading presses are manufactured today by firms such as Lee Precision, Mayville Engineering Corporation (MEC), Ponsness-Warren and Texan; possibly by others as well. When purchased new, such presses are supplied with instruction manuals giving full details of the procedures for using them. Should you come into possession of a press and the instruction booklet is missing, write to its maker, furnishing such information as you can supply regarding the model number and serial number, if either or both of those is visible. Most, if not all, of the makers will be glad to supply you with a copy of the given instruction manual, often for no cost or, at most, for a modest charge.

It is of extreme importance to operate the shotshell reloading press strictly in the manner its manufacturer recommends. More, it is at least equally vital to reload shotshells in strict adherence to reliable loading data.

In other chapters, we've spoken of the desirability of sorting handgun/rifle cartridge cases as to headstamp for

* Just as the book was going through final proofreading, word arrived that the old Hollywood loading presses are being resurrected by a new firm, Hollywood Loading Tools, Inc., 7311 Radford Avenue, North Hollywood, California 91605. The phone number is 213/875-1131. The same maker offers dies and conversion equipment for reloading shotshells on these presses, as well as the usual handgun and rifle cartridges. A brochure listing prices is available on request. — DAG





Facing page: Kent Cartwright in the process of resurrecting 12-gauge hulls with a Ponsness-Warren Mult-O-Matic loader in his craftily engineered facilities. Empty hulls were fetched home in the Du Pont shopping bag. Holes were made in the bench top to permit spent primers to drop into the Folger coffee can and loaded rounds to fall into the suspended plastic bucket, as indicated by arrow in the adjacent photo. Purely for the record, I had to blow about six frames on the 6x7cm Pentax before I managed to catch that loaded shell on its way!

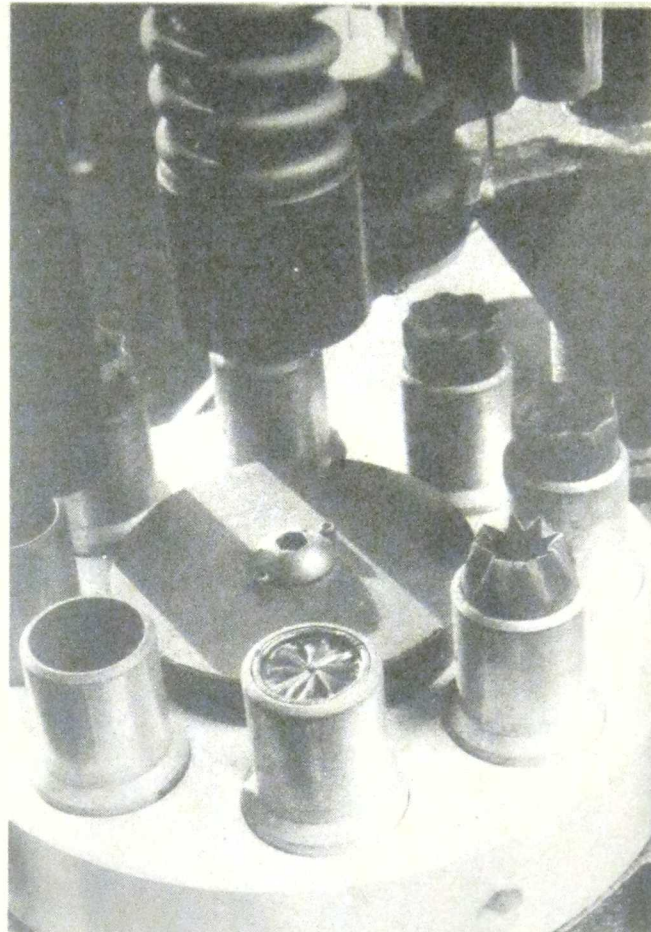
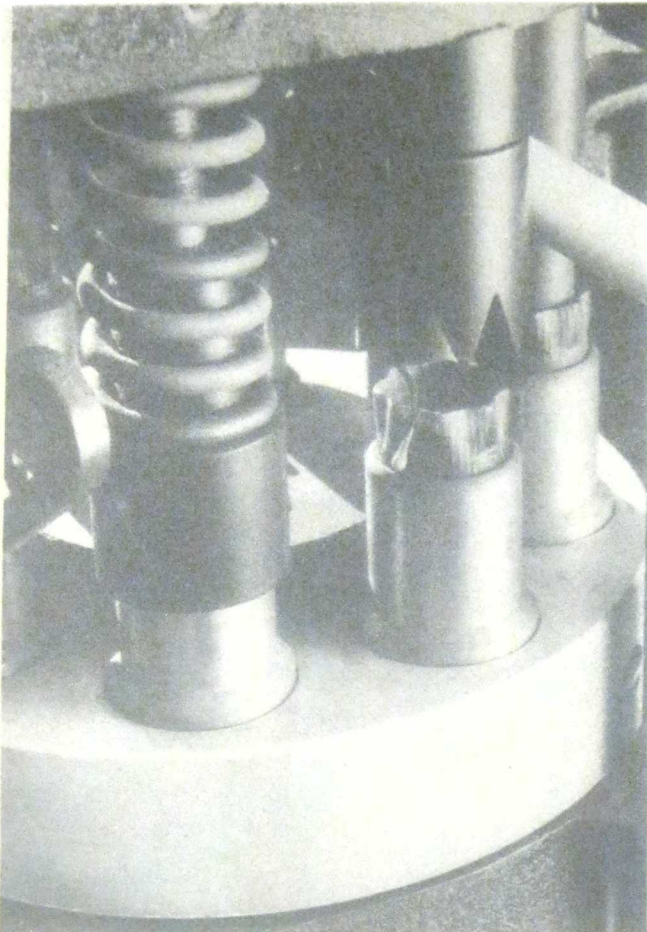
the sake of uniform performance. Sorting cases as to make and specific type is vastly more important when reloading shotshells. At present, there are about forty-five different shotshell hull designs in the various gauges and lengths. At least, Cougar's book lists and illustrates that many. Each of the forty-five must be handled and reloaded according to load data for that case and for that case, alone. In most instances, the data specifies the exact make/type of both the plastic wad column and the primer, stipulating that no substitutions be made in either.

The reason behind all this heavy load of admonitions is that shotguns operate at peak pressures much lower than those commonly encountered in handguns or rifles. They are not at all forgiving of adventurous forays on the part of the reloader and can — quite possibly will — blow up if improperly fed.

The design and operating principles of shotshell reloading presses vary so widely it is somewhere between difficult and impossible to offer much by way of specific comment on the necessary procedures. That's one reason I urgently recommend getting a copy of the op-manual for the given press you plan to use.

As a generalized observation, most shotshell reloading presses provide a number of *stations*, at each of which one or more operations are performed. On some designs, the operator moves the shell from station to station manually. Others have a revolving shell plate — either manually or automatically moved — which transfers the shell from station to station. In the latter example, it is common for the press to perform the several operations on a number of shells simultaneously.

That's to say, for example, the first station may punch



Coming down the backstretch on the Ponsness-Warren 800 Size-O-Matic: (At left) The crimp-starter has an exploratory finger to line up on the crease left from the previous crimp. (At right) We see a case mouth after the crimp-starter has done its work and another after going through the final crimp.

out the old primer and perhaps resize the shell full-length. The next station may seat a new primer. The powder charge may be dropped in the third station. A wad column may be seated in the fourth station. The shot charge may be dropped in the fifth station and the next two stations may start and complete the crimp.

In point of fact, few if any shotshell loaders have that many stations since most of them combine some of the operations in a single station.

Two innovations have made a vast difference — and improvement — in the process of reloading shotshells. The first was the folded crimp that replaced the original overshoot wad and rolled crimp. The second was the plastic wad column that superseded the older card overshoot wad and felt filler wad.

Applying the rolled crimp to the front end of the shell

was a time-consuming operation with no visible way around it. Restoring the folded crimp, sometimes termed the “pie crimp,” is vastly quicker and simpler. Folded crimps may have six folds or they may have eight folds. This depends upon the number of folds in the original factory loading and it’s rarely satisfactory to go vice versa and finish a six-fold shell with an eight-fold crimp or the other way around.

Today’s plastic wad column provides sealing — “obturating” — flanges around the edge of the side that goes next to the powder, serving to harness all of the powder gas generated at the time of firing. Rather than letting some escape past to scramble the performance of the shot charge. The portion of the wad just ahead of the base is designed to perform a controlled collapse as the shot charge starts to move up the barrel, and the slit skirts at the front protect the soft lead shot pellets from abrasion against the bore wall,

keeping them from getting flattened. A flattened pellet will not fly in close formation with those that remain reasonably spherical.

Customarily, shot is supplied in twenty-five-pound sacks in the commoner sizes, say from about #2 through #9. The larger buckshot sizes usually come five pounds to the bag. The average dealer in reloading supplies doesn't usually stock the more exotic sizes and you may have to obtain them on special order.

There is considerable disparity and confusion in the

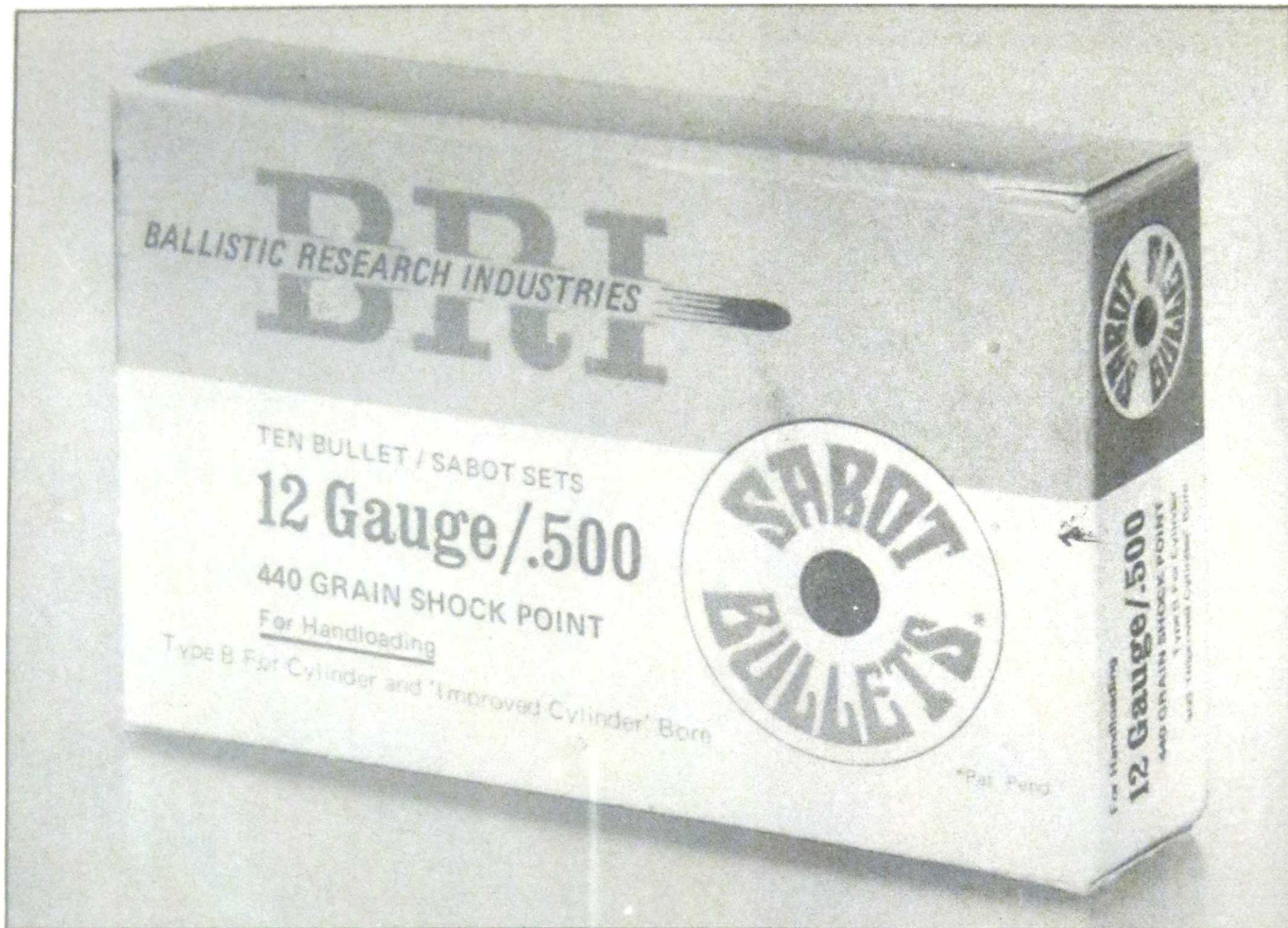
matter of designating buckshot in the different sizes. Typically, #00 — voiced as "double-ought" — buckshot is about 55 grains. The cited figures may vary from those obtained by dissecting, measuring and weighing #00 buckshot pellets from bags or loaded shells. I'll try to provide a chart of shot pellet sizes here, but it's emphasized that the figures may not coincide with the pellets you have.*

Diameter and weight of the individual shot pellet has a drastic effect upon its rate of velocity loss during passage through the air. The smaller the pellet, the more rapid its

* See Chapter 29.

Operating a progressive shotshell reloading press requires the ultimate in heads-up alertness. If you forget to put a wad column into the wad seater, you get a shell without any wad, such as the hapless example at the left, here. Such misfits should be summarily deep-sixed. Don't try to fire them!





The BRI sabot-powered shotgun slug loads are eminently effective and accurate. The operation has hopped about over the years like unto a flea on a hot stove lid and the latest address, as this goes to press, is Ballistic Research Industries, 6000-B Soquel Avenue, Santa Cruz, CA 95062. Write to them for details.

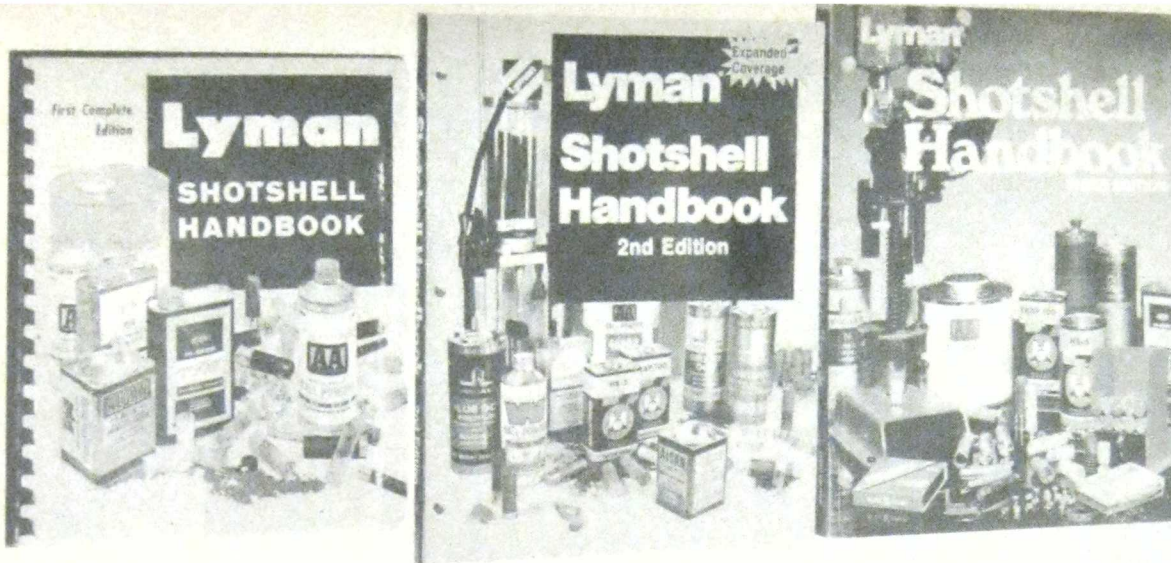
loss of velocity. Conversely, larger pellets will show a vast increase in the range at which they remain dangerous and in penetration at any shorter distance.

I had hoped to include some information here on reloading with slugs or round lead balls of fairly close to full-bore diameter. In surveying the current state of the art, it appears the necessary components no longer remain on the market. I've discussed the process in earlier editions of ABC/R and in a chapter I wrote for *Reloading for Shotgunners*.

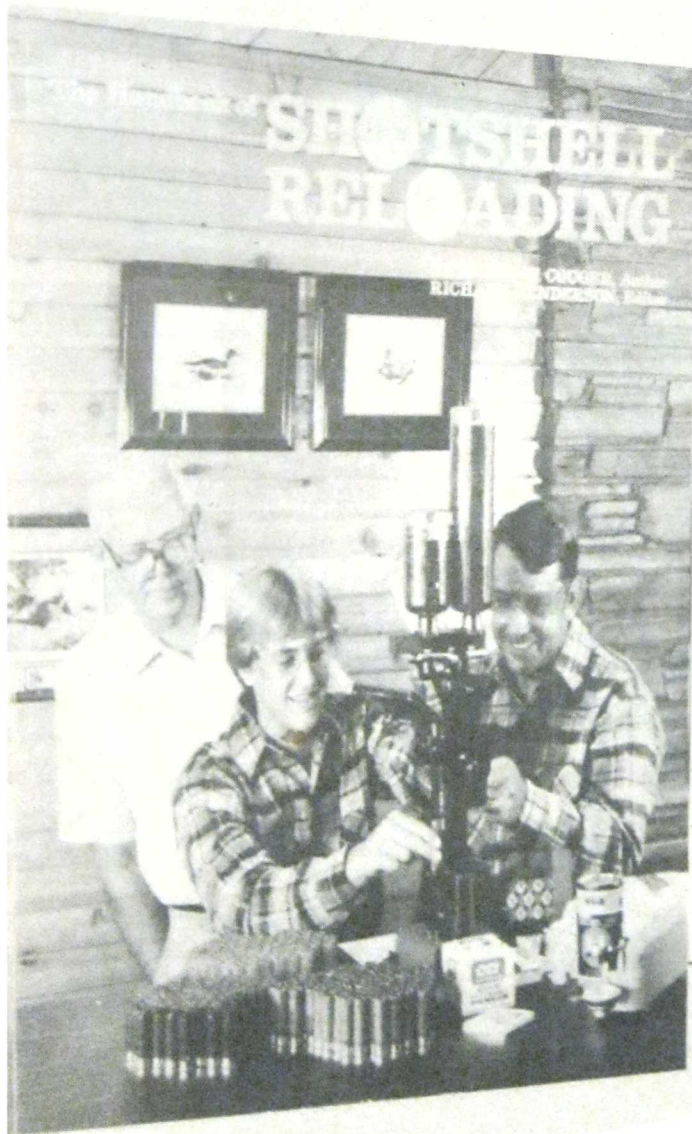
About the only current source giving any attention to reloading shotgun slugs is the #24 Hodgdon Manual. They specify a "BPGS" wad for 12-gauge slugs and do not elaborate upon the abbreviation. I'm not sure if that means some sub-type of the old Alcan PGS wad — it stood for Plastic Gas Seal — or if it's something else.

In years past, I've had encouraging results in firing round lead balls of .672-inch diameter in the more open-bored shotguns. That's somewhat smaller than the diameter of the 12-gauge, typically about .729-inch to the rear of the choke. I put the ball in a Federal #7/8 Pellet Protector plastic wad column and found it delivered accuracy that didn't compare too unfavorably with typical factory slug loads.

The .672-inch lead ball, as cast from a Lyman mould of that diameter, shows a typical weight of 442 grains — one ounce, you'll recall, is 437.5 grains — and, when inserted in the wad column, mikes right close to .729-inch. I used to load those in a Federal Champion II plastic hull, using a Federal #209 primer. My charge was 30.0 grains of Alcan AL-5 powder — no longer available, alas. Out of the twenty-six-inch skeet barrel of my Remington Model 870



Three editions of the Lyman Shotshell Handbook have appeared to the present, as illustrated above.



ABC'S OF RELOADING

pump, it averaged 1331 feet per second (fps) and 1739 foot-pounds of energy (fpe). Typical fifty-yard groups were on the order of six to eight inches in spread.

I packed the empty space just ahead of the ball with granular polyethylene and gave it a conventional folded crimp, finding the resulting shells fed nicely through the action of the Model 870. The purpose of using a plastic wad column is to prevent the round ball from picking up any unwanted rotational spin in its passage up the bore. I would counsel against firing such a load in a gun having a full choke barrel, due to the risk it might damage the choke. In fact, I don't recommend the load as such, but mention it here solely as a possibly interesting bypath in shotshell reloading.

While a lot of game has been taken with reloaded shotshells, the high-volume shotshell reloader usually practices it for making up skeet or trap loads. Among the illustrations for this chapter are some photos taken of old friend Kent W. Cartwright in the days when he had his Ponsness-Warren Mult-O-Matic press set up in his workshop for maximum efficiency at resurrecting the bag of spent hulls fetched back from a session at the local skeet range.

Cartwright's reloading activities were somewhat ramified by the fact that he shot a 12-gauge while his wife, Becky, favored a 20-gauge, with which she was disquietingly deadly. The P-W press was a good choice for his needs because it was quickly convertible from one gauge to

Ken Cougar's Handbook of Shotshell Reloading is a highly detailed and authoritative work on the complex subject.

“



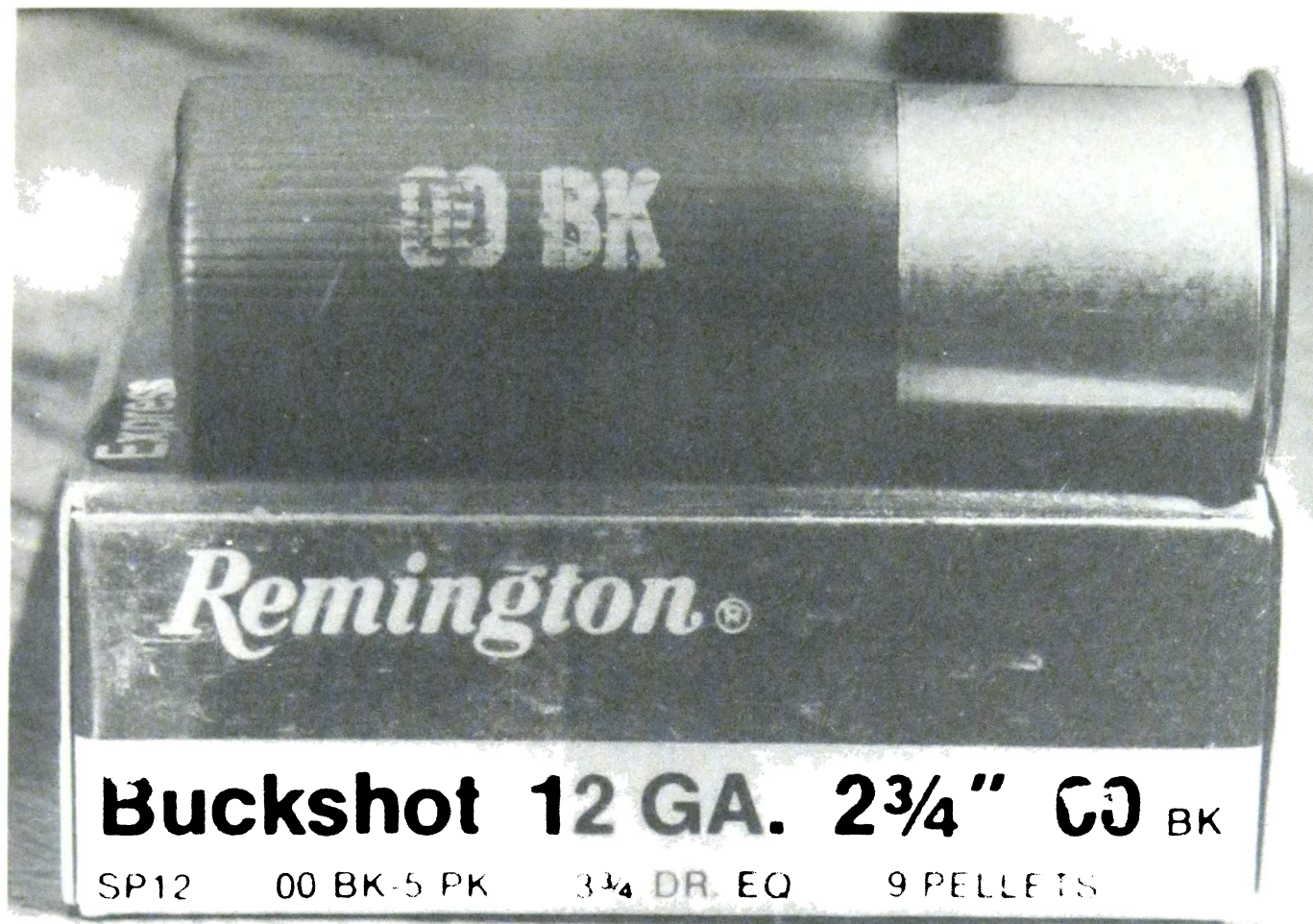
Long obsolete, all-brass shotshells required special wads because of larger inside diameter. (Left) Examples of the six-fold and eight-fold.



Below: The Brenneke slug is available as slug or loaded round.



The world-famous Original BRENNKE shotgun slug is most suitable for deer, big game, pachyderms etc. on account of its excellent killing power. On battue particularly preferred for wild boars. BRENNKE shotgun slugs can be fired from every smooth barrel with all choke configuration and guarantee highest precision up to 50 meters.



Buckshot loads turn the humble shotgun into a really formidable firearm. Above is an example as loaded by Remington. (Left) The low-base and high-base loads in 2 3/4- and 3-inch lengths for the 12-gauge factory loads.

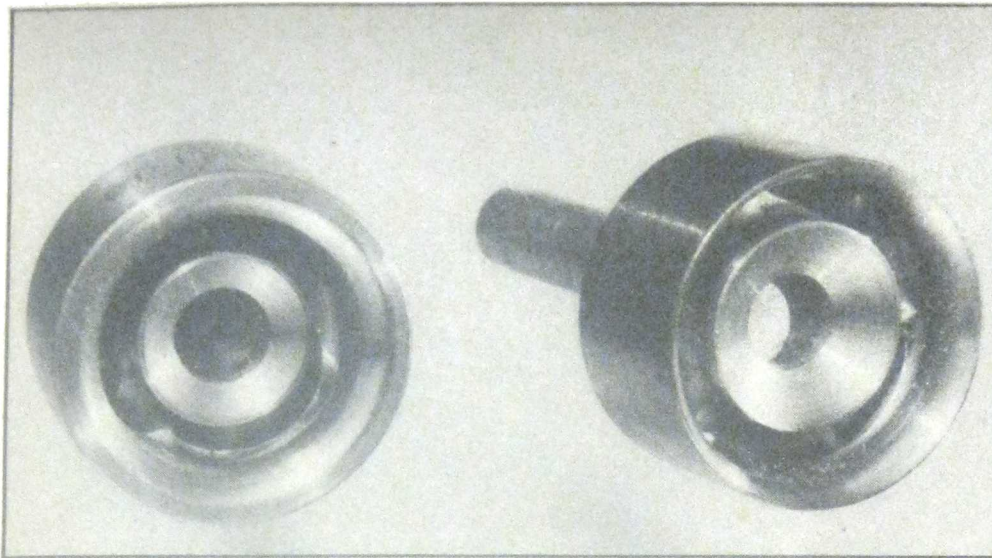


another. Its shell plate moved progressively and automatically as the handle was operated and, once set up and going, it produced a loaded shell with each full stroke of the handle.

The loaded shell was ejected from the loading tube that enclosed each shell on its tour through the stations. That approach assured production of reloads that were within the prescribed body diameter of factory loads.

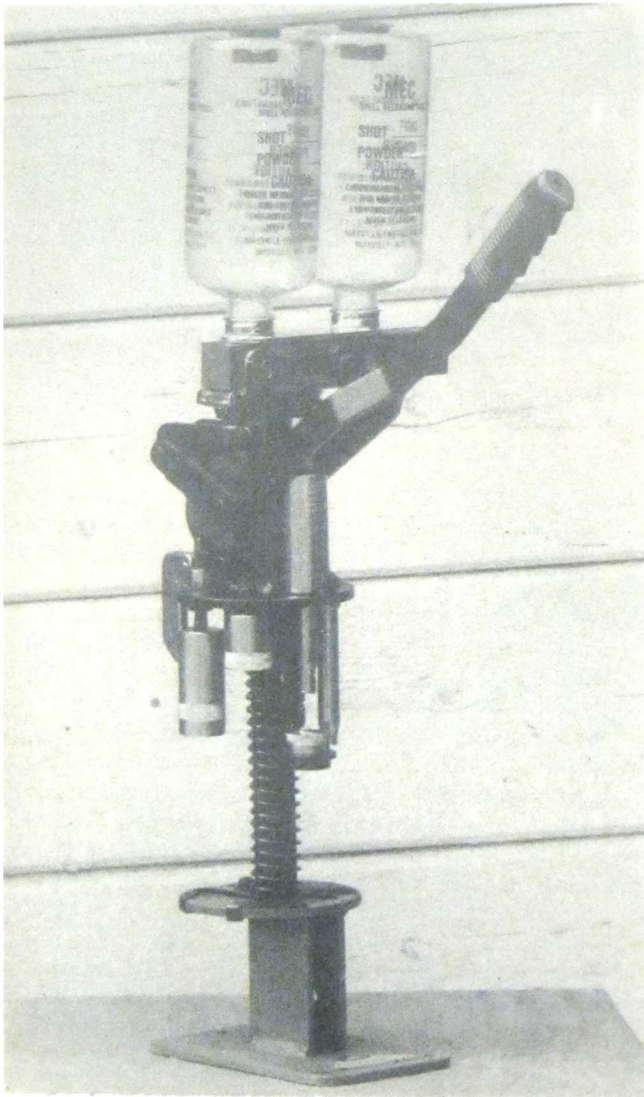
You'll note that Cartwright cut a hole in his bench top at the proper place and hung a plastic bucket beneath it to catch the loaded shells as they were punched out of the big P-W unit. He had another hole and another container to catch the spent primers. I thought — and still think — it represented a good example of thoughtful arrangement and refining of the operation.

Candidly, the most difficult aspect of that long-ago photo session was in the synchronizing of his reflexes and mine toward the end of catching a finished shell in midair on its way to the bucket. I was using an electronic flash unit on the 6x7cm Pentax and it appears I caught the plummeting shell on the sixth try.

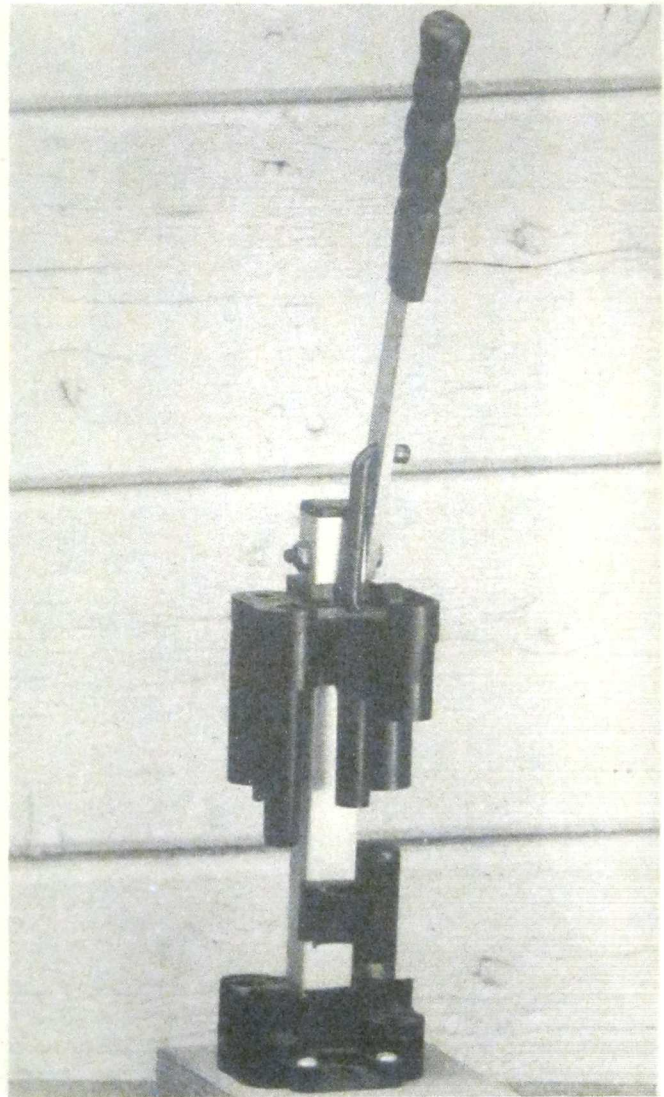


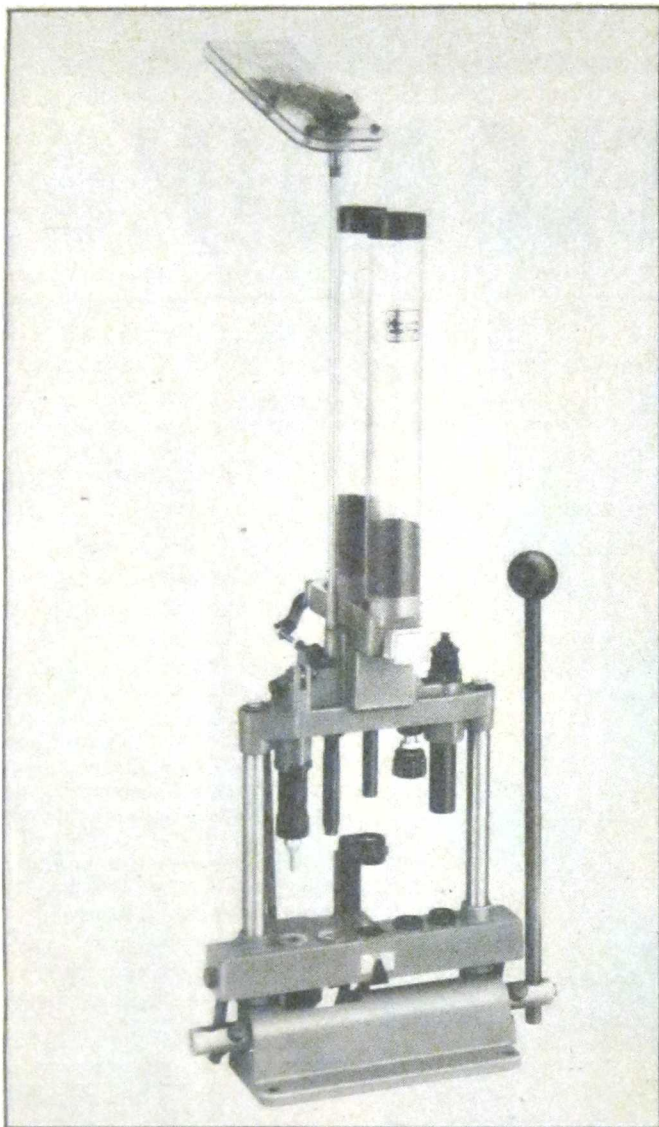
At latest report, Lyman continued to make the 20- and 12-gauge heads for roll-crimping shells.

Mayville Engineering Company continues to make the MEC shotshell presses in many models.

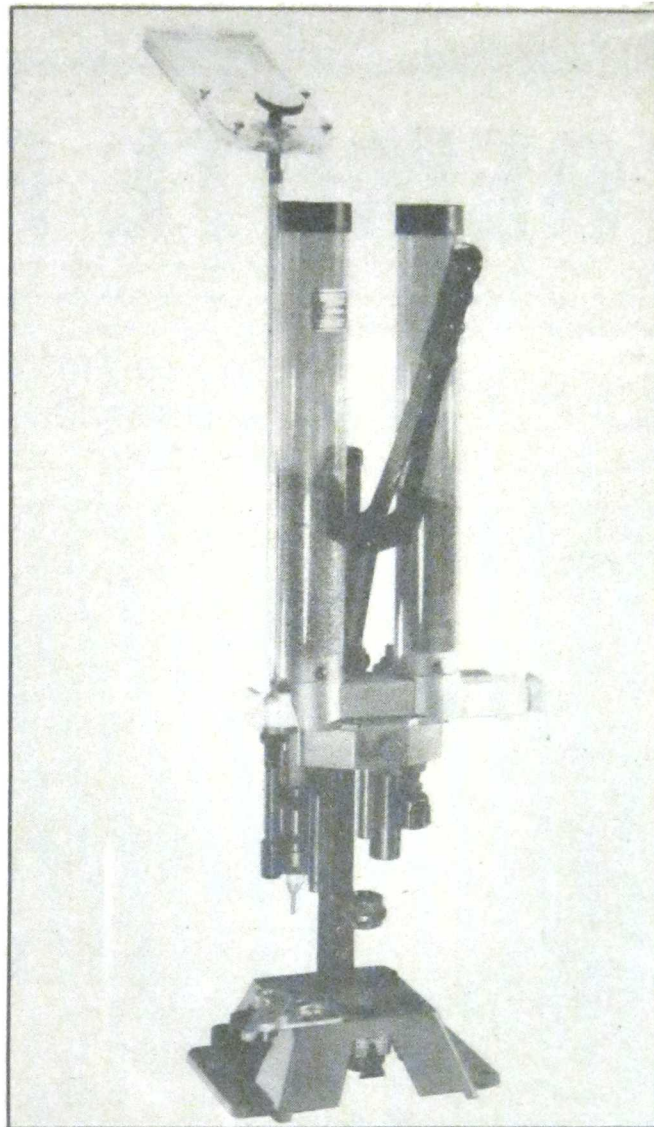


Lee's Load-All Junior remains the lowest-priced of all the shotshell presses on the market.





Hornady/Pacific's Model 266 shotshell press.



The Hornady/Pacific Model 155 shotshell press.

Virtually all shotshell reloading presses — of which I'm aware — utilize some manner of volume-type measure for dispensing both the powder and shot. MEC has bored charge bars, with a clever arrangement to prevent dispensing powder from the shot cavity and vice versa. Others use basic bars that accept little bushings to drop the desired weight of powder and of shot, while still others employ dipper-type measures for both.

In any and all such instances, it is a good idea to verify that the actual weight dropped corresponds to what you had in mind, by use of an accurate powder scale. As we've discussed, powder density can and fairly often does vary from lot to lot. The shot-measuring cavity is probably dead-on for some given shot size, but the identical volume of #2 shot will weigh a bit less than the same quantity of #9 shot because the latter packs in a bit more tightly, with less air in the spaces between the pellets.

The important thing, when checking the weight of the drops on a shotshell press is to obtain the quantities to be weighed via a routine operation of the press through all its

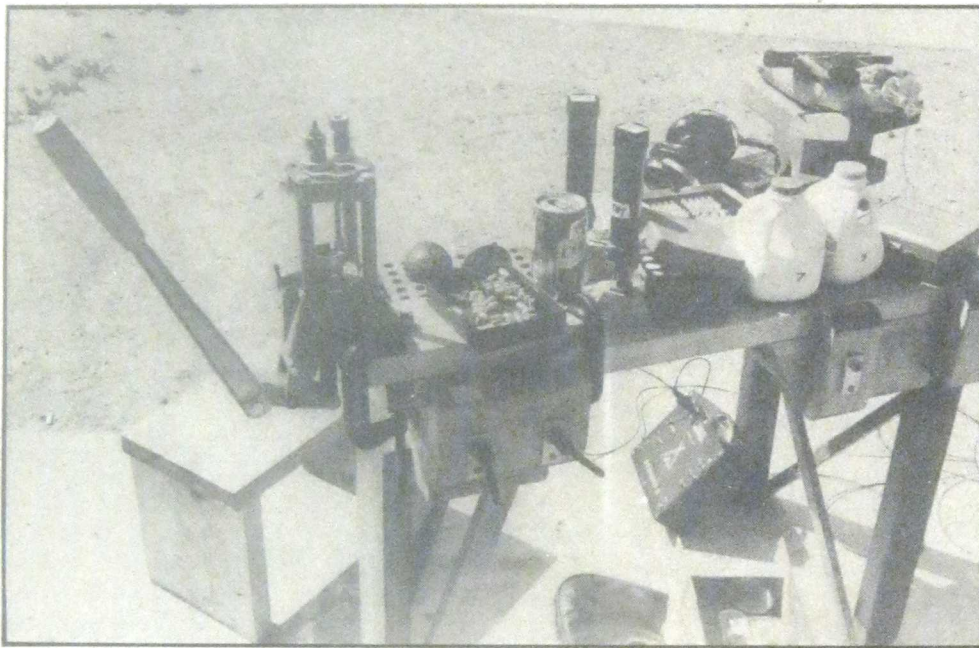
usual operations. Don't just actuate the measure, catch the charge and weigh it. Catch it only after performing all the usual operations in sequence. The reason for that is the vibration of operation tends to pack powder granules and perhaps even shot pellets a bit more closely than they'd be on an unvibrated drop.

To present, all informed sources — even including this one — are vociferously unanimous on one point: *Do not try to reload shotshells with steel shot!* The compelling and urgent reasons are manifold. Shot pellets of the necessary softer steel are not available to the reloader. Even if you salvaged them from factory-loaded shells carrying steel pellets, you still would not have the specialized plastic wad columns that are absolutely necessary for safe and harmless firing of steel shot. Refer to page 282.

Any attempt to disregard or bypass this flat-out warning is quite certain to result in damage to the gun and/or shooter and/or bystanders. Burn that into your memory circuits, even if you don't remember another thing from this entire book.

REMOTE RELOADING

There Are Times When It's Helpful
To Make Them Up Just Prior To Shooting



Here, the portable shooting bench has been, uhh, pressed into duty as a remote reloading bench for the purpose of developing load data for the Bren Ten and its 10mm ammo. The Lee Precision turret press positions both seating and taper-crimp dies. A quantity of load-ready cases were made up beforehand. RCBS Little Dandy powder measures were used.

ANY NUMBER of situations can make things highly advantageous for reloading at the shooting site. At best, such a project poses challenges; at worst...

One such hypothetical state of affairs is that in which you have doodley-zilch by way of load data for the cartridge at hand. I have found myself in that particular simmering kettle of smelts on more prior occasions than I really care to look back upon. I can confide that it may trigger nightmares for years to come. For example, when the .350 Remington magnum cartridge was all fresh and ink-dripping off the drawing board, I found myself with a Remington Model 600 of that resolute and implacable chambering, plus some factory loads, plus an urgent assignment from the magazine for which I labored at the time, to get some reload data going on the cartridge.

Candidly and confidentially, I would sooner enter into a discussion on how to tease cobras suffering from rabies than on how to work up a load in a new cartridge. The reason is that readers of such discussions would probably be safer in pestering the hydrophobic snakes. I think I can demonstrate what I mean by that, if you'll just read along here.

The basic stratagem in such instances is to start way down low, or even a bit under that, and work up with extreme care, being prepared to stop and back off at the very first faint suggestion that you've gotten up into hazardous levels. To do so, there is hardly any satisfactory substitute for packing afield all the necessary gear needed for making up loads as you go along. On practically all such projects, time is of the sharpest essence and it helps a lot if you have load-ready cases on hand in generous abundance.

The biggest problem lies in the controlled dispensation of the powder charges. The faithful powder scale does not tend to operate well when taken afield from its usual resting place on the loading bench. The faintest vagrant zephyr of moving air tends to send a powder scale into one-way hysteria, even if it's mounted on a dead-level surface. For many years, I've thought about the desirability of making up a windproof enclosure, capable of being leveled in both directions, for using powder scales out amid the raw elements. Perhaps I'll get to finalizing the matter, one of these years when there aren't too many ominous deadlines with which to cope.

At any rate, we were speaking of a time in the early

Sixties when the .350 Rem mag was on the scene, but there was no load data for it at all. I took the rifle and cases and assorted bric-a-brac up to Dick Lee's and we repaired to his back-forty range to grapple with the matter. By the time we were done, we had gotten the 180-grain Speer JSP bullets whistling out of the muzzle of the short barrel at a notably brisk 3400 feet per second (fps). Now that's good for a mind boggling 4622 foot-pounds of energy (fpe) and the lightweight carbine bucked like you'd never be able to believe.

I did not write up that particular load and, for that, I remain mutely grateful, every time I happen to think of the matter. After some number of months, Speer brought forth the next edition of their manual and gave their listing for the .350 Rem mag. I will note the fastest load for their 180-grain JSP in their current (#10) manual is 60.0 grains of Hodgdon BL-C2 for 2942 fps/3460 fpe. Now, that's still not a load in front of which to hold the casual finger, but it's a long way down from 4622 fpe; right about 1162 fpe short, to be reasonably precise.

As I've carefully noted, independent development of load data is a damned chancy go, at its best, and even less attractive at its worst. As a sport, blindfold bobsledding down wooded slopes probably is a lot safer.

In late 1974, I had an invitation to travel to Sweden and, in preparation for the trip, had to obtain a passport for the first time in my life. I filled out the application blank with all the usual statistics: six feet tall, weight 180 pounds, eyes brown, hair brown...

"I'm afraid I'll have to put the hair down as brown/gray," the clerk interrupted at that point.

Well, that was a decade or so ago and I still can't find the words to thank her properly. The top-mop is now beginning to verge toward gray/brown, but slowly. I tend to blame the gray ones on the times I've been forced to work up load data from scratch, as in the foregoing example.

Moving up to within the month still going by on the calendar, I found myself assigned to develop load data for the 10mm Auto cartridge, as handled by the Bren Ten. All the usual first-night jitters hit me as hard as ever, perhaps even harder. My first charge weight with one given powder proved to be at least two notches too high up the scale. I worked down to approximately duplicate the factory load's performance, with just a trifle to spare. Along the way, I was driving 200-grain bullets out of that sturdy auto pistol as fast as 1481 fps for a reading of 974 fpe. The factory load goes at 1155/593. Sorry, details on all that are not available on request, not even if you enclose a self-addressed stamped envelope (SASE).

If you find yourself forced to reload afield, I suggest you make a dummy setup in your driveway and make certain you have all the needed components and gear before loading up and moving out.

If you're not using tungsten carbide resizing dies, you'll need case resizing lube and a means for getting the lube off the case after resizing. What works well for that is a K-Spinner and a cordless drill to spin it, plus a generous supply of paper towels.

If you only contemplate a limited number of loads and shots, you can get by nicely by taking along a batch of load-ready cases. Merely drop the charge of powder into them, seat the bullet, add a taper-crimp as indicated and fire

away. Don't forget a container to hold the spent cases for their return to the bench. Likewise, remember to take along a funnel for getting unused powder back into the containers.

As a means for dispensing the experimental or time-proven powder charges, I know of nothing that works quite so well as the RCBS Little Dandy with all twenty-six rotors in the MTM 12-gauge shell box; one in the measure, the other twenty-five in the box, of course. Either before or after the session, you can determine just how many grains of such-and-such powder is thrown by rotor number so-and-so.

Take along a clipboard or stenographer's notebook for recording the data resulting from the test session. Write all the pertinent dope next to the resulting group on the target for future reference. Hardly anything is quite as frustrating as to dot in a great group and have no faintest inkling of what went into the loads that produced it.

Even if you're not engaged in experimental load development — and, again I say, that's strictly for experts of long experience — on-site reloading can be helpful if you happen to be working with a cartridge for which you've but a limited number of cases, or if you're planning to remain on the same shooting site for an extended stay.

On-site reloading is by no means restricted to the metallics. You can do it with shotshells as well. Many years ago, my old MEC-400 loader was attached to a piece of plywood and it worked just fine while resting on the hood (British readers please read "bonnet") of the family auto of that time. On one session, I was working with a Browning single-barrel trap gun sporting a tube something like thirty-four inches in overall length. By switching charge bars about on the MEC-400, I came up with a super-reduced load that just barely shoved all the pellets out the muzzle with a sort of diffident cough. We were hand-trapping the claybird targets and the super-squib load could be fired, nearly as the bird reached the far end of its flight. Just as it was within a yard or so of hitting dirt, the clay would turn into a coarse black burst of ack-ack. It was indelibly memorable. I have not, to the present day, ceased to regret that I didn't manage to liberate that old claygrinder from the good people in Morgan, Utah. There are a couple of other scatterguns about which I feel much the same.

Remote reloading can assume several forms. You can pack along a Lee Loader kit or one of the nice old Lyman #310 tong tools to resurrect your spent hulls at night on a camping or hunting trip. Don't forget the primers, bullets and powder, as well as the means for dispensing the powder. As was noted, stage a dry run while you're still at home to make certain you're not overlooking a really vital piece of gear.

Back in the days when I was a traveling salesman, I loaded uncountable rounds of ammo while cooling my roving heels in assorted motels about my territory. What was really soul-balmy was after I got my first electric melting pot, when I used to cast thousands and thousands of bullets on wattage unwittingly provided by the motel owners. Most of those folks put 25-watt bulbs in the lamps next to the beds to provoke instant eyestrain if you tried to read yourself to sleep. In those days, I packed a couple of 150-watt bulbs in my suitcase. I commend that to your consideration, if you travel about in making your living.

UNSAFE COMBINATIONS OF GUNS AND AMMUNITION

Here Are Some — Not Necessarily All! — Of The
Cartridges One Might Be Able To Chamber,
But Which Would Be Dangerous If Fired.

EVERY NOW and again, a discarded cartridge case bears mute testimony of a dangerous mistake. As a few examples, a friend once passed along the badly mutilated head of a .38 Colt Super cartridge that some misguided soul had fired in a .38 Special revolver, demolishing the gun. On another occasion I found an empty .303 Savage case that had been fired in a rifle chambered for the .303 British round. Elsewhere in the present book, there's discussion and illustrations of a 7x57mm Mauser cartridge I fired in a rifle that — as I learned later — had been rebarreled and converted to .270 Winchester, without any helpful notice appearing on the outside of the barrel.

For a time in the late Forties, I owned a Model 24 Winchester side-by-side double-barreled shotgun that was chambered for the 2 $\frac{5}{8}$ -inch 16-gauge shell. It was a delightful old gun, but the shorter 16-gauge shell was all but obsolete, even then, having been replaced by the 2 $\frac{3}{4}$ -inch 16-gauge shell that is still the standard version. Many of those old short-chambered 16-gauges have been reamed to accept the 2 $\frac{3}{4}$ -inch shell, or at least we can hope they have been. To fire a standard-length shell in the short chamber would be extremely hazardous. I mention all this in the

event some reader happens to inherit or otherwise acquire an obviously elderly 16-gauge shotgun. In high probability, a 2 $\frac{3}{4}$ -inch shell can be chambered but, upon being fired, the folded crimp would not have room to unfold behind the forcing cone and extremely high pressures would result.

The Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) has prepared a listing of ammunition that is unsafe if fired in any of several specified guns. No pretense is made or implied that this is a complete listing. In point of fact, I noted they did not list the combination of a .38 Colt Super cartridge in a .38 Special revolver and I've added that to their list. The .38 Colt Super cartridge is loaded to pressures considerably higher than the usual figure for .38 Special revolvers. I would even counsel against trying to fire a .38 Colt Super in a revolver chambered for the .357 magnum or .357 Remington Maximum because the jacketed bullet would have a lengthy "jump" before reaching the constricted section at the front of the chamber and would be apt to upset and experience a temporary blockage on reaching it.

If you have any question regarding the correct ammunition for a given gun, consult a reliable gunsmith. There may

be a moderate fee for the examination, but it would be a most attractive bargain when compared to the possible cost of firing the wrong ammunition in the right gun!

The SAAMI listing follows:

In the interest of safety, the Sporting Arms and Ammunition Manufacturers' Institute, Inc. (SAAMI) has prepared a list of what it considers to be possible improper combinations of arms and ammunition. SAAMI cautions that this list does not necessarily cover all possible unsafe combinations of guns and ammunition. It is emphasized that nearly every firearm, no matter where produced, is marked in some manner to indicate the proper cartridge or shell for use in that particular firearm, and only the proper load as marked should be used. It may be dangerous — in fact usually IS dangerous — to attempt to utilize any other load than the one for which the gun has been chambered and inscribed.

To get the current list of unsafe arms and ammunition combinations, write SAAMI, P.O. Box 218, Wallingford, CT 06492.

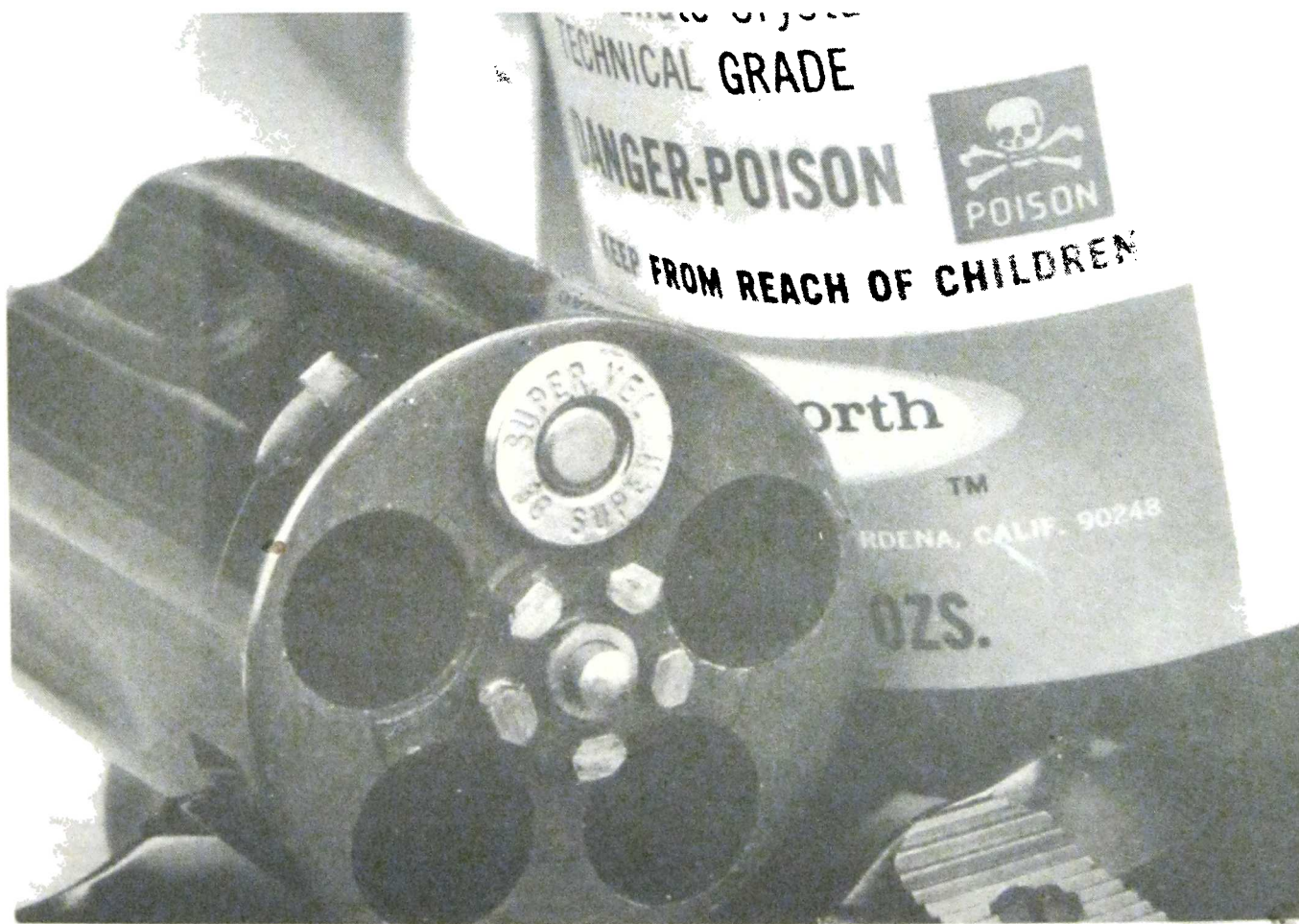
Ammunition used in a firearm must be the same caliber or gauge as that marked on the firearm by its manufacturer.

If the firearm is not marked as to caliber or gauge, or if it appears that the original marking has been overprinted or changed, it is the responsibility of the gun user to have a qualified person determine what cartridge or shell can safely be used in the firearm.

The firing of a cartridge or shell other than that for which the firearm is chambered can result in the cartridge or shell rupturing and releasing high-pressure gas that can damage or destroy the firearm and kill or seriously injure the shooter and persons nearby.

There are countless combinations of specific cartridges and firearm chambers which are unsafe. Many of these unsafe combinations are recognizable because of significant dimension differences between the cartridge and the firearm chamber. Dangerous combinations may also have similar chamber and cartridge dimensions. It is not possible to list every unsafe combination; therefore, in the interest of safety, use only the cartridge (or shell) designated

A purely poisonous combination if there ever was one! One round of .38 Colt Super, otherwise known as the .38 ACP +P, has been chambered in the Smith & Wesson Model 36 Chiefs Special. The revolver is chambered for the .38 Special cartridge and I prefer not to use even the .38 Special +P loads in it.



by the caliber or shotshell gauge must be marked on the firearm frame, receiver or barrel by its manufacturer.

The practice of rechambering firearms is not guided by industry standards. It is possible that a firearm which has been rechambered may not be rechambered properly or the rechambered caliber may not be marked on the firearm. The firearm user is responsible to find out from a qualified person the cartridge caliber or shell gauge for which the firearm has been rechambered.

RIMFIRE RIFLE

In Rifles Chambered For	Do Not Use These Cartridges
.22 WRF	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot
.22 WMRF	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot
.22 Win Auto	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot
5mm Rem RF magnum	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot .22 Win Auto
.25 Stevens Long	5mm Rem RF magnum

RIMFIRE PISTOL & REVOLVER

In Handguns Chambered For	Do Not Use These Cartridges
5mm Rem RF magnum	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot .22 Win. Auto
.22 WRF	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot
.22 WMRF	.22 BB, .22 CB .22 Short .22 Long .22 LR .22 LR Shot
.25 Stevens Long	5mm Rem RF magnum

CENTERFIRE PISTOL & REVOLVER

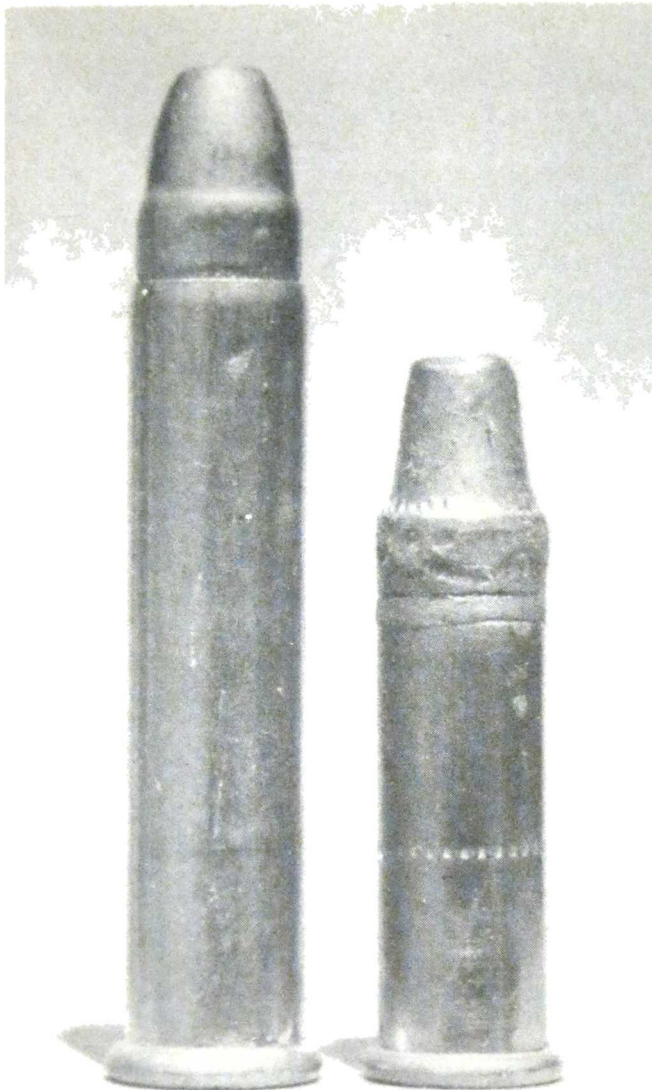
In Handguns Chambered For	Do Not Use These Cartridges
.32 S&W	.32 Auto .32 Long Colt .32 Short Colt
.32-20 Win	.32-20 High-Velocity



Here's a look at the .38 Super (left) with the .38 Special cartridge. Both are of the same diameter and the .38 Super has a slight rim, but it's loaded to nearly twice the working pressure of the .38 Special, making it extremely hazardous to fire in the .38 Special revolver, as discussed here.

.38 Auto	.38 Super Auto +P*
.38 S&W	.38 Auto .38 Long Colt .38 Short Colt .38 Special
.38 Special	.357 magnum .38 Super Auto +P
.38-40 Win.	.38-40 High Velocity
.41 magnum	.41 Long Colt
.44-40 Win.	.44-40 High Velocity
.45 Auto	.38-40 Win .44 Rem magnum .44 Special .44-40 Win.

*+P ammunition is loaded to a higher pressure, as indicated by the +P marking on the cartridge case headstamp, for use only in firearms especially designed for this cartridge and so recommended by the manufacturer.



Although the .22 WMRF (left) fires bullets of the same diameter as the .22 LR (right), WMRF has larger case diameter, resulting in dangerous bulging if .22 LR is fired in the WMRF chamber.

7mm Express Remington (cont.)

7mm Mauser (7x57)

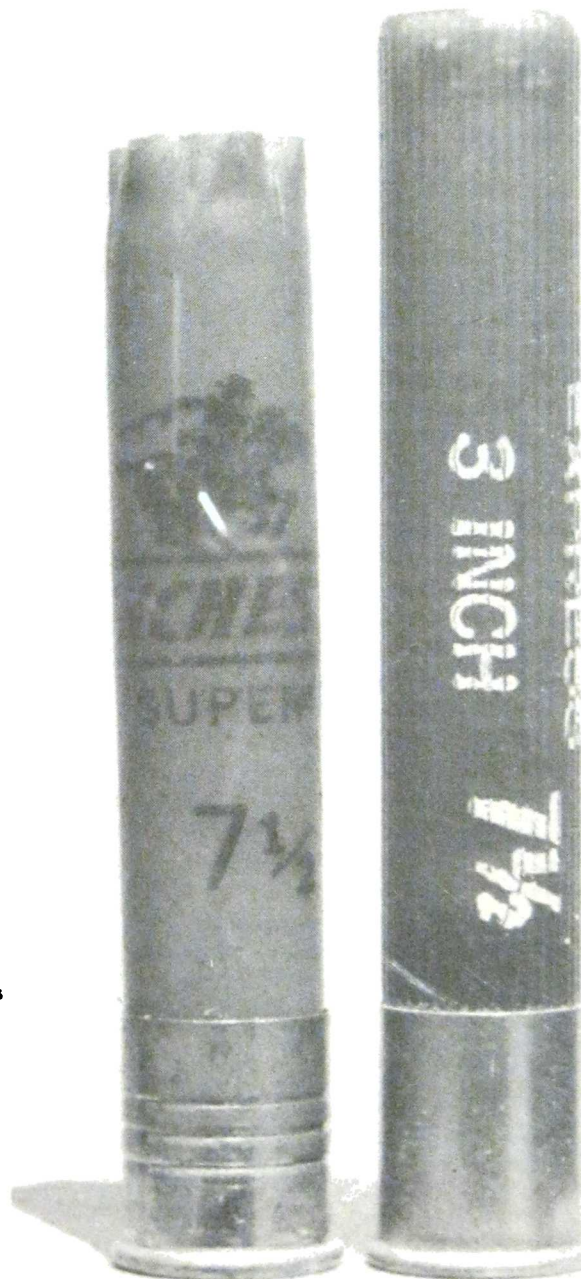
7mm Remington magnum

.32 Remington
.375 Winchester
.38-55 Winchester

.300 Savage

7mm Express Remington
7mm Mauser (7x57)
7mm Weatherby magnum
.270 Winchester
.280 Remington
.303 British
.35 Remington

A fired 2½-inch (standard) .410 shell is at left. If gun is chambered for this shell, the mouth of a three-inch magnum .410 (right) unfolds beyond the chamber in firing and it would produce extremely dangerous pressures. Make sure the ammo fits!



.45 Colt

.38-40 Win.
.44 Rem magnum
.44 S&W Special
.44-40 Win.

CENTERFIRE RIFLE

In Rifles Chambered For  **Do Not Use These Cartridges**

6mm Remington
(.244 Rem)

.250 Savage

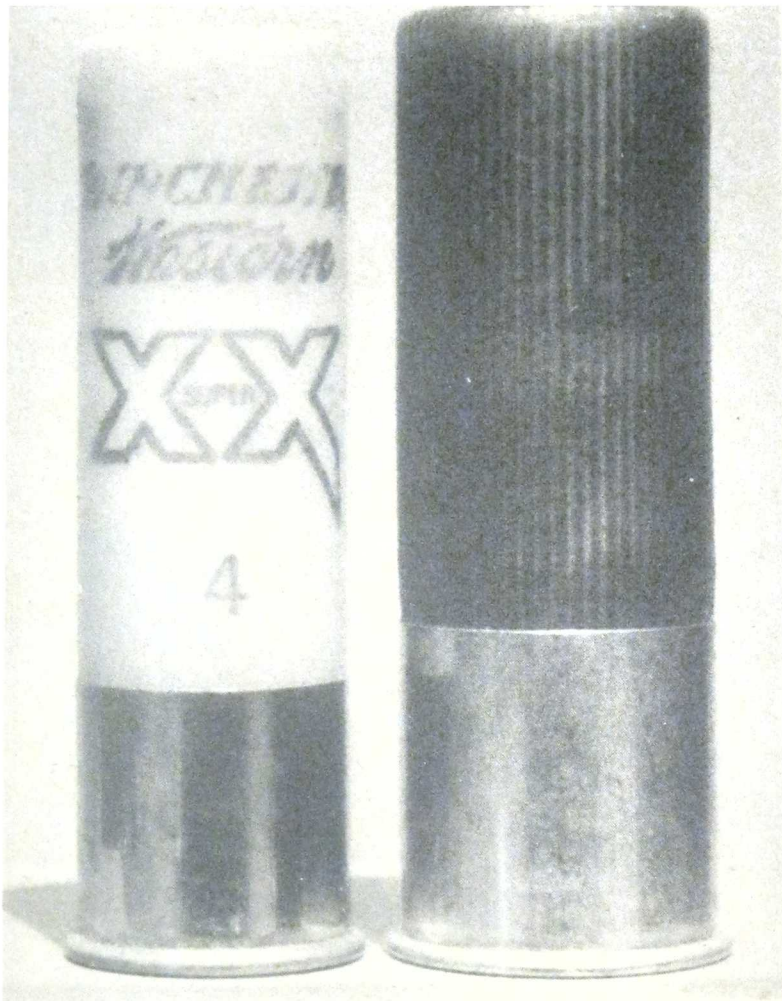
6.5mm Remington
magnum

.300 Savage

7mm Express
Remington

7mm Mauser (7x57)

.270 Winchester
.30-30 Winchester
.300 Savage
.308 Winchester



Most manufacturers standardize on yellow for their 20-gauge shotshells as a ready means of identification. Should a 20-gauge shell be dropped into a 12-gauge gun, it is usually possible to put a 12-gauge shell in behind it and, if that is fired, it is highly probable the gun will blow up.

**7mm Remington
magnum (cont.)**

8mm Mauser (8x57)

8mm Remington
magnum

.17 Remington

.17/.223

.223 Remington

.243 Winchester

.257 Roberts

.264 Winchester
magnum

.350 Remington magnum
.375 Winchester
.38-55 Winchester

7mm Mauser (7x57)
.35 Remington

.338 Winchester magnum

.350 Remington magnum
.358 Norma magnum
.375 Winchester
.38-55 Winchester

.221 Remington Fire Ball
.30 Carbine

.17 Remington
.221 Remington Fire Ball
.30 Carbine

5.56mm Military
.222 Remington

.225 Winchester
.250 Savage
.300 Savage

.250 Savage

.270 Winchester
.284 Winchester
.303 British

**.264 Winchester
magnum (cont.)**

.270 Winchester

.280 Remington

.284 Winchester

.30/06 Springfield

.30-40 Krag (.30 Govt)

.308 Winchester
.350 Remington
.375 Winchester
.38-55 Winchester

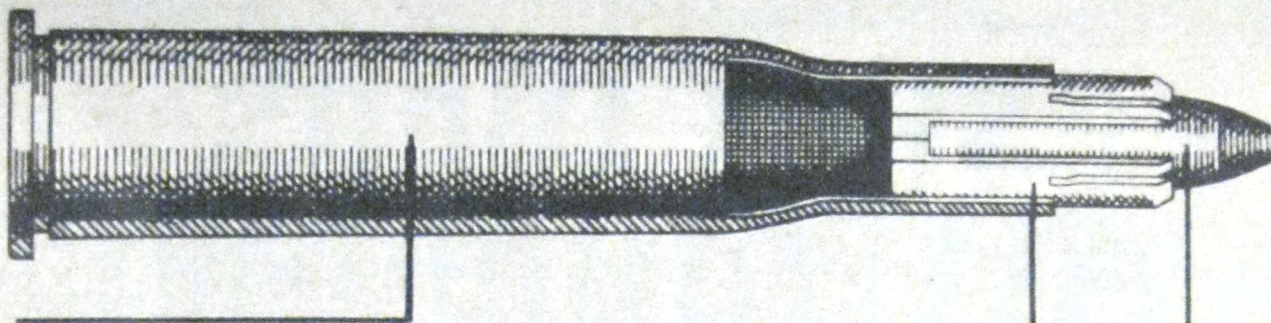
7mm Mauser (7x57)
.30 Remington
.30-30 Winchester
.300 Savage
.32 Remington
.375 Winchester
.38-55 Winchester

7mm Mauser (7x57)
.270 Winchester
.30 Remington
.30-30 Winchester
.300 Savage
.308 Winchester
.32 Remington
.375 Winchester
.38-55 Winchester

7mm Mauser (7x57)
.300 Savage

8mm Mauser (8x57)
.32 Remington
.35 Remington
.375 Winchester
.38-55 Winchester

.303 British
.303 Savage



BRASS CASE: Same famous Remington brass that is used in all center fire cases.

SABOT: Unique plastic collar that allows the use of the smaller, lighter bullet which can be driven to higher velocities.

BULLET: Specially designed Remington bullet of smaller diameter and lighter weight than ordinarily used in this caliber.

Here's one example where a small bullet can be fired in a large bore with perfect safety, provided the gun is chambered for the given cartridge and in good condition. Remington makes these Accelerator cartridges in .30-30 WCF (shown here), .308 Winchester and .30/06 Springfield, with bullets of .224-inch diameter.

.30-40 Krag (.30 Govt.)

300 Holland & Holland magnum

300 Weatherby magnum

300 Winchester magnum

303 British

303 Savage

.308 Winchester

338 Winchester magnum

348 Winchester

32 Winchester Special

8mm Mauser (8x57)

.30-06 Springfield
.30-40 Krag
.375 Winchester
38-55 Winchester

338 Winchester manquam

8mm Mauser Rd. Nose bullet
303 British
350 Remington magnum
375 Winchester
38-55 Winchester

32 Winchester Special
303 Savage

32 Winchester Special
32-40 Winchester

300 Savage

375 Winchester
38-55 Winchester

35 Remington

.375 Winchester

375 H&H magnum

.38-55 Winchester

.38-55 Winchester
.41 Long Colt

.375 Winchester
38-55 Winchester

375 Winchester
41 Long Colt

SHOTGUN*

In Shotgun Chambered For

10-gauge
12-gauge
12-gauge
16 gauge x 2 3/4"
16-gauge
20-gauge

In Shotgun Chambered For

410 bore

Do Not Use These Shells

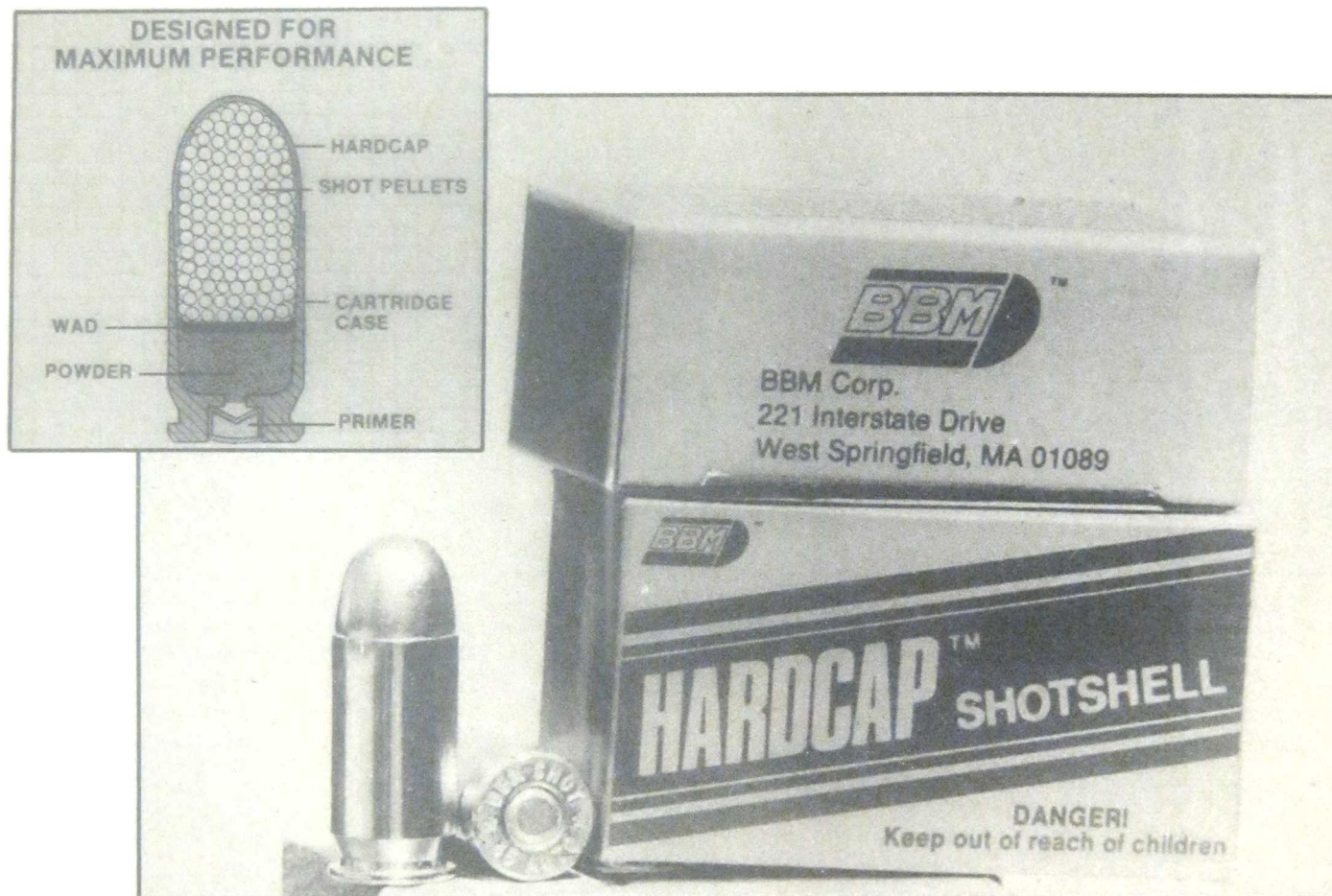
12-gauge
16-gauge
20-gauge
16-gauge x 2 3/4"
20-gauge
28-gauge

Do Not Use These Centerfire Metallic Cartridges

Any

*With any gauge, shotshells of a given nominal length should not be fired in a gun the chamber length of which is shorter than the fired shell length, e.g., a 3" (75mm) shell fired in a 2 3/4" (70mm) chamber.

SHOT LOADS FOR HANDGUNS



The BBM Hardcap is one of the most interesting loads to come along in a lengthy while. Initially offered in .45 ACP, soon to be available in 9mm Luger, with other calibers perhaps to come, it has the unique capability to work autoloading actions to deliver a leaden sleet, pocketa-pocketa. Pattern spread varies considerably with the given gun. One of the tightest-patterning guns I have is a 1918-vintage S&W revolver with its barrel bobbed to four inches. Six rounds of Hardcap from that makes fine-grain Swiss cheese of any target within 10-15 feet. BBM hopes to offer components.

PRIOR TO 1934 or so, there were hardly any restrictions as to the sort of firearms the law-abiding civilian could own and operate. John Herbert Dillinger presumably purchased his Thompson submachine gun through routine commercial channels because its serial number — 6444 — is pegged to his name in records of the manufacturer, as are the Chicago pianos of several other notorious ruffians of that distant era.

If you hankered after a compact pocket shotgun, there were several totally legal options, among them the neat little Marble's Game-Getter, a folding-stock model that fired the 2½-inch .410-bore shotshell, and quite effectively. If you wished to add a shoulder stock to a pistol, no one took umbrage nor alarm over it.

It is a moot and debatable point whether or not a lot of the firearms variants that were "outlawed" — more about that in just a bit — in one fell swoop by the Firearms Act of

Notes And Thoughts On Several Approaches Toward Multi-Projectile Pistol Possibilities



Omark/CCI offers shot loads in .22 LR, .22 WMR, .38 Special and .44 magnum. The rimfire versions are of limited utility, but the center-fires perform well. Refer to text.

1934, figured heavily in the crimes that certainly were running seriously rampant at the time. Then, as now, a miscreant bent upon breaking laws in wholesale quantities, could buy a cheap side-by-side double-barrel shotgun and spend a few moments with hacksaw and sandpaper to convert it into an awesome and formidable device that could be concealed beneath a topcoat for terrorizing honest shopkeepers or pacifying members of rival gangs.

Curiously enough, conventional shotguns were offered with short barrels and pistol grips by some of the manufacturers. Such productions were termed *whippet guns*. I'm not certain as to the derivation of the term. A whippet is sort of a turbocharged ~~gray~~hound; with a capital W, it was also the marque of an automobile of the late Twenties era. I doubt if it derived from "whip it out and go blam!"

Be all that as it may, the GCA '34 put short shotguns, silencers, full-auto guns, shoulder-stocked pistols and several other specified items under severe restrictions. Subject to laws of the given state, such things still can be bought, kept and used to the present, provided you go through the necessary red tape and remit a transfer tax of about \$200. Thus, they're not exactly outlawed, but their obtainment is restricted and expensive.

As for those firearms subject to no more than routine restrictions, a rifle must have a barrel at least sixteen inches in length, a shotgun barrel must be at least eighteen inches and either gun must have an overall length of at least 26½ inches. Anything shorter than that becomes a handgun, and smoothbore handguns are a federal no-no, subject to registration and payment of transfer tax, as noted.

Now there is a considerable body of public enthusiasm for combining the widespread pattern of a shotgun with the compact portability of a handgun. "Snake loads" is the usual term for such things. Subject to possible vagaries of state law, no one minds terribly if you discharge more than a single projectile per shot from a handgun, but the gun in question had better have a rifled barrel or you're in big trouble if you're caught using it or even in possession of it.

If you fire a charge of shot down a barrel that's rifled, the rifling will impart some amount of swirling motion to the charge. That results in a pattern we'll term *toroid*, roughly doughnut-shaped. The centrifugal force of the swirl causes a rapid dispersion toward the circumference, with a hollow area in the center.

That, then, is the situation, the basic ground rules that have prevailed for the past half-century or so. Quite a bit of inspired ingenuity has been expended toward solution of the basic problem. Some amount of success has been achieved. That's the topic for the chapter at hand.

Quite early on, the rimfire shot load emerged. They were offered in .22 long rifle and, later, in .22 WMR. Typically, the shot pellets are of #12 size, often termed

dust. Penetrative capabilities of such tiny pellets are severely limited. They are capable of busting a rubber balloon from a fair distance, assuming a scored hit. The .22 LR version may not be able to get through one thickness of an aluminum beverage container and that's quite thin. Give it a try to prove that to your own satisfaction. Snake load? Only for thin-skinned garter snakes in their early youth.

Most such loads still are put up in elongated cases with a folded taper crimp up front. Omark/CCI puts the pellets in a neat little blue plastic capsule. None of these loads will function in an autoloading pistol, although they'll cycle nicely in revolvers of the suitable chambering.

Omark/CCI-Speer also markets shot capsules consisting of a cylindrical foreportion plus a gas-sealing rear cap. They are available in .38, and .44 sizes. You fill them with shot pellets in the diameter of your choice. Alternatively, factory loads are available in .38 Special and .44 magnum. The .38 size is for use in either the .38 Special or the .357 magnum, and they say there's nothing to be gained in trying to hot-rod it to the higher .357 mag velocities.

If you buy the .44 empty capsules, you're perfectly free to put them up in .44 Special cases for use in either .44 Special or magnum guns on the same operating principle. Nevertheless, the factory .44 load comes in .44 mag cases that won't chamber in .44 Special revolvers. Loading data for either caliber is printed on the package, in the instance of the empty capsules.

Either the factory loads or those made up from the empty capsules are a lot more effective than the .22 rimfire loads. Curiously enough, the pattern isn't too badly scattered within the first ten or fifteen feet and the penetrative capability is pretty decent, depending somewhat upon the shot pellet size selected. Properly made up and fired, such cartridges in either size are quite capable of viperizing a

vapor — uhh, vaporizing a viper (sorry 'bout that!). Or you can use them for other applications that happen to seduce your fancy.

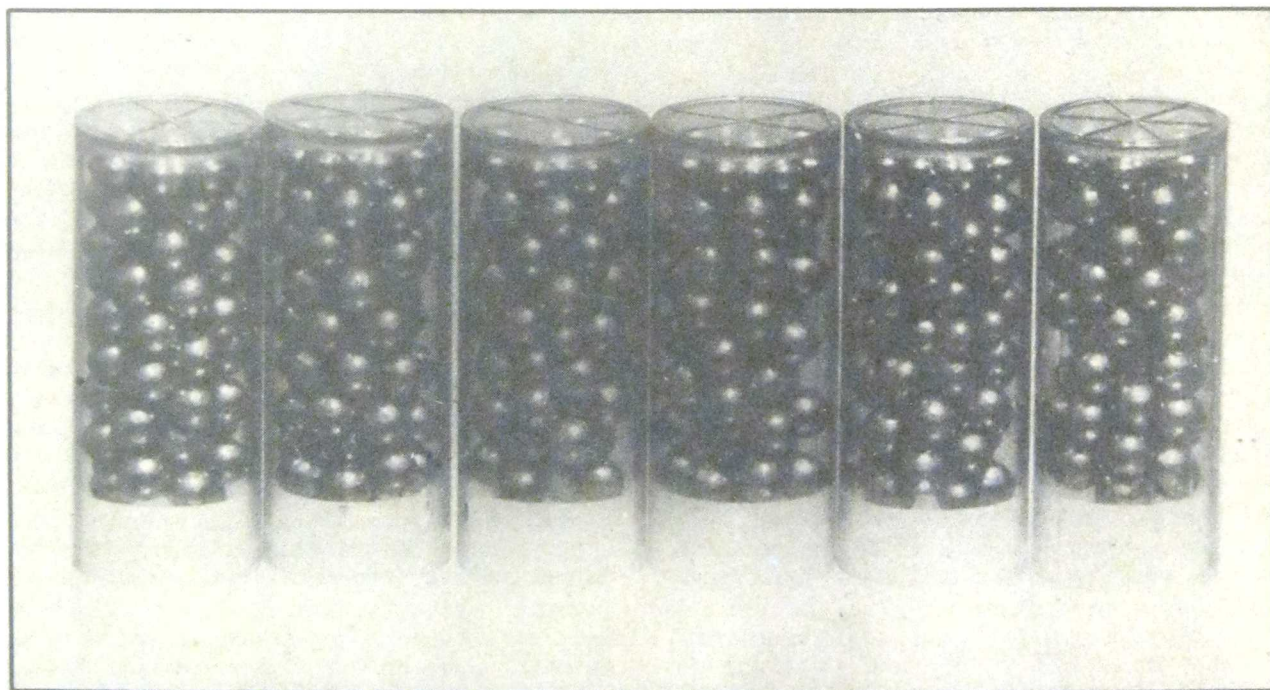
Early in 1975, I had occasion to drive to Houston in the Opel GT that was my special delight in those days. As I was cruising on the surface instead of up in the wary skies of United Airlines or whatever, there were no X-ray shake-downs to worry about so I right joyfully packed hardware and ammo for same. You see, I have this friend who infests the south end of San Antonio, name of Tom Ferguson, FACEB, RTP&BP. The first honorific is for Fellow of the American College of Experimental Ballisticians. If you've got to know what RTP&BP stands for, send me a stamped self-addressed envelope.

After attending to affairs in Houston, Ferg and I eventually gravitated back to the San Antone area and, in the course of time, found ourselves at a nice little garbage dump not far from the boundaries of Randolph Field, an installation I recalled well from a long-ago conflict.

My foresight in arming the Opel heavily and well for its trip, really paid off then. We proceeded to perforate cans with ebullient euphoria, not to mention with an extensive battery of arms and ammo I'd ferried along for that express purpose. As episodes go, it's one still recalled fondly.

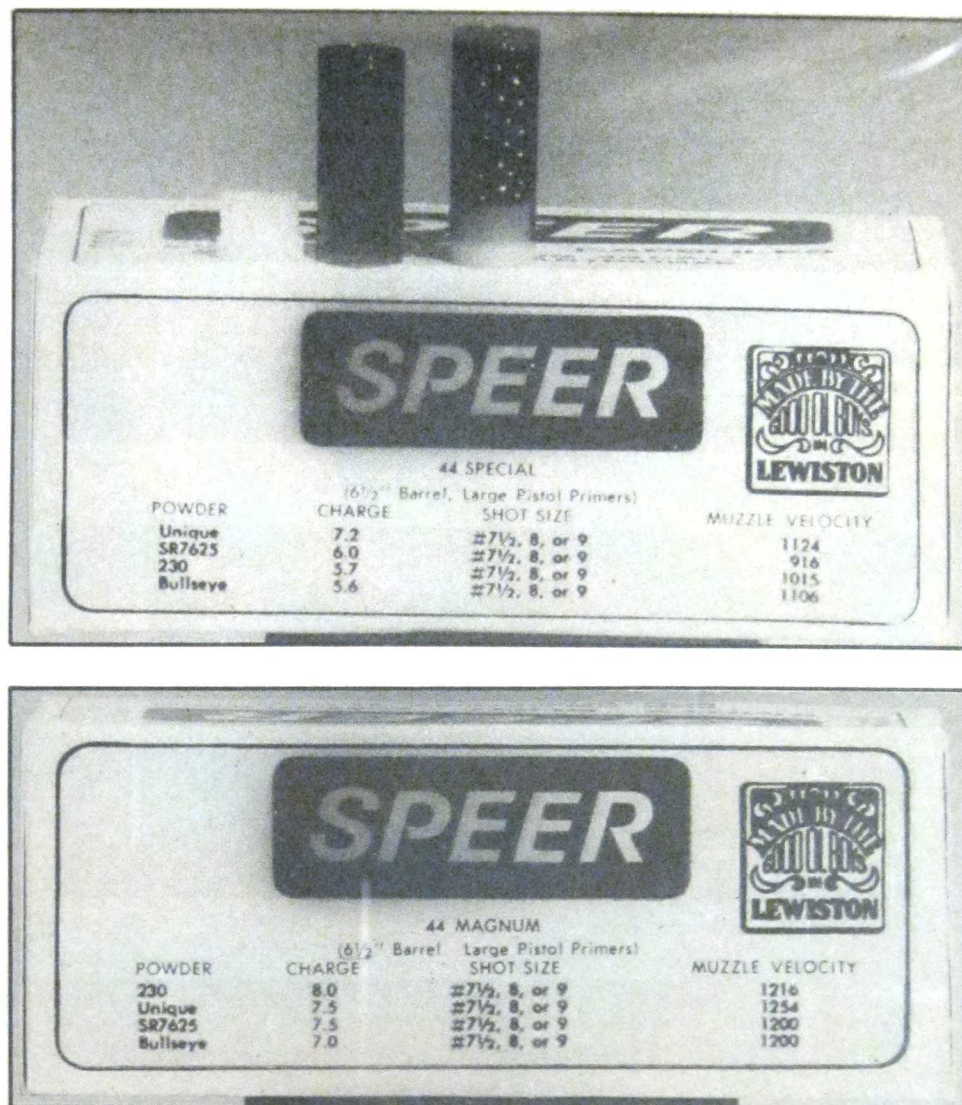
So, at length, it came to pass that I policed up a spent .45 ACP case and requested Ferg's attention to what I was about to do. Holding a cocked Colt Detective Special in my right hand — I'm a northpaw — and the empty hull in my left, I gave all the signs of being ready to essay an aerial shot.

Ferguson protested that there were occupied dwellings in the fallout quadrants if I fired upward aiming that way, so I pivoted until his misgivings were pacified. Then, I flicked the empty .45 hull skyward with my left hand and,



A sextet of Omark/Speer capsules filled with #4 shot in .44 size: a handgun equivalent of grapeshot!!

Boxes in which the empty Omark/Speer capsules are packed carry load data for the appropriate calibers.



with a lightning stab of the Colt's snubby muzzle, pressed its trigger.

It was a perfect shot. The flying case was hit, but not so hard that the viewer's eye couldn't see it spinning madly up, up, up and away.

The effect upon Comrade Ferguson was, to understate a bit, salutary. His jaw dropped, his eyes glazed over and his breath came in short pants. In just a fraction of a second, I had won a niche in his esteem, right up there with Davy Crockett and Jim Bowie. I basked in his admiration for but a brief but blissful while. Ruminating upon the matter, I could see trouble ahead. Sooner or later, my path was due to wend back to San Antonio again, as it does at stochastic intervals. Next time, I could visualize Ferguson setting me up to stage a demonstration for the blueclad ranks of all the SAPD members not on active duty at the given moment. When that happened, some slit-eyed blighter was fairly certain to ask for a look at the ammo I was using.

I sighed. "Ferg, there's something I have to tell you."

I unlatched the cylinder of the little Colt and ejected the rest of the loads, extending them for his examination. "Shot loads," I explained to him.

The kaleidoscopic play of emotions across his honest Hiberno-Caledonian features was something to see. At one point there, I was on the thin verge of vaulting into the

Opel to flee for my life. In the end, he emitted an ironic chuckle and I let my held breath out in relief.

As I'm sure you've suspected all along, I had performed my miraculous feat of aerial sharpshootery with the helpful aid of a round of .38 Special carrying a Speer shot capsule filled with #9 shot. I won't guarantee it'll enable you to score aerial hits on flying .45 empties, but I'll stoutly maintain it simplifies the possibility of such feats quite usefully.

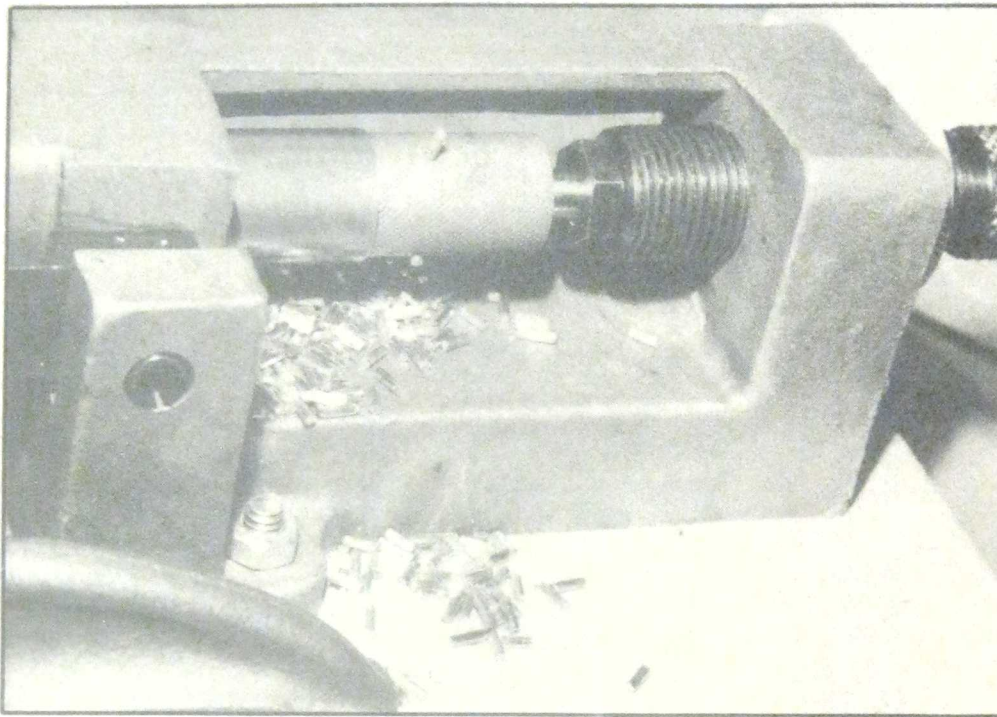
An inadvertant pun rears its revolting head at this point and I must ask your forgiving indulgence (please?): Tomfoolery aside, the Speer capsules in the various sizes have a great deal of helpful application to offer. I would put the limit of their useful range at somewhere on the order of twenty to perhaps thirty feet. Within that radius, their effect is gratifyingly telling. You can even stuff them with buckshot of the suitable diameter that fits, packing two, perhaps three pellets into the load and rationing out the powder at an amount proportional to the projectile weight, as determined by consulting a reliable manual or handbook. I'll not stipulate the size of buckshot because, as noted in Chapter 23, such things vary rather berserkly. Suffice to say, if you play your cards eptly, you can turn a Ruger Security-Six into a formidable Security-Twelve or perhaps even a Security-Eighteen.

It took the devious ingenuity of Warren Center to come up with a truly effective, reasonably long-range shot load for handguns. Not content with giving us the T/C Contender single-shot pistol, he went on to scheme up three different barrels for use on the basic T/CC chassis.

I believe the first of the series may have been the one that

they call **Hot Shot** capsules of shot pellets up front. Either diameter of capsule is available in a variety of pellet sizes and they're offered as factory loads or as capsules alone. Load data for putting up the capsules is printed on the box.

In the T/C Hot Shot system, the removable choke tube



If you make jacketed bullets, by-products of the core-swaging operation can be used as langrel loads in the Omark/Speer capsules.

fired the .45 Colt cartridge, often called the .45 Long Colt, meanwhile also being capable of setting off a round of .410-bore shotshell. It had all the necessary rifling to legally handle the .45 LC but, at the same time, it had a removable muzzle choke tube that made it capable of doing excellent work with the conventional shotshell. The choke had lands and grooves, rather generous ones, but they were parallel, rather than helical in format.

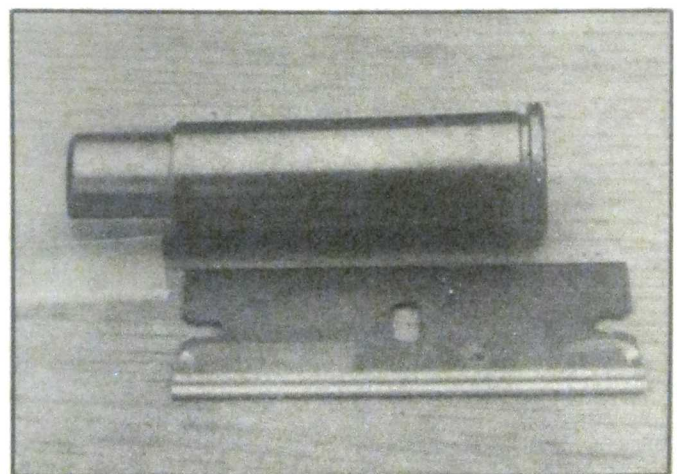
Thus, the normal rifling set the shot charge to swirling and then it got to the choke tube that arrested the swirling. The cloud of pellets came out the muzzle with all the tiny gobbets of lead sizzling along in a remarkable single-minded manner. If you wished to hurl forth bullets from .45 LC cartridges, you merely unscrewed the choke tube and blazed away: a truly elegant solution to a galling problem!

Initially, Thompson/Center had run the idea of the .45 LC/.410 barrel past personnel at the Bureau of Alcohol, Tobacco and Firearms (BATF) and had been told they saw nothing wrong with it. With the barrels in production, someone at BATF had searching second thoughts and the word came down they'd a whole lot rather T/C would cease and desist making them. "We hate to see pistols available for shotshells," was approximately the way they put it.

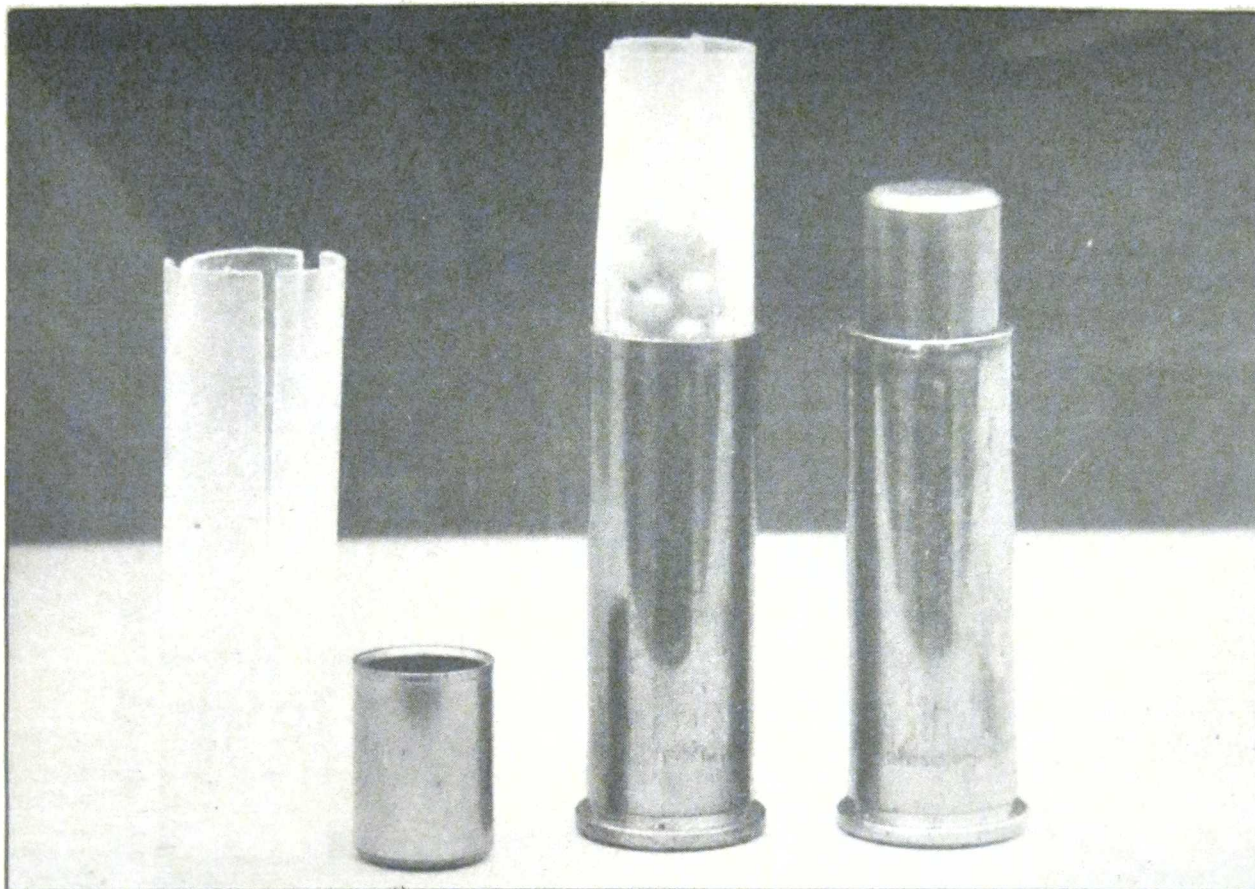
Ever cooperative, T/C phased out the .45/.410 barrel and replaced it with barrels of comparable concept that handle loads put up in .357 or .44 magnum cases with what

serves a dual purpose. Not only does it arrest and redirect the swirling shot charge, but it also serves to shred the fairly tough outer body of the capsule, releasing the pellets to go their merry way. If you fire a Hot Shot load without the choke tube in place, it's quite apt to go forth intact and keyholing madly. You need the choke to open it up.

The T/CC with a ten-inch .44 Hot Shot barrel and corresponding load doesn't give much edge in performance to



One of the described shotloads for the .41 magnum, in the process of having its surplus plastic trimmed.



The .41 mag shotload in fuller detail: Dip pellets in a .38 Special case to within about 1/4" of the neck. Use 4.0 grains of Bullseye as the driving charge. Insert the .410 wad, then the pellets, then the .38 bullet jacket and crimp firmly. Use a single-edge razor blade to trim off the excess plastic wad column.

conventional .410 shotguns. I have put running Idaho jack-rabbits down for the long count with the T/CC at distances out to forty yards, as witnessed and attested by Steve Herrett and Hugh Farmer. They used to run a photo of the rabbit and me in the T/C catalog, giving the distance as thirty yards, for the sake of enhanced plausibility.

If you hanker after a one-hand shotgun, the T/C Hot Shot is the best choice in terms of pattern and performance available to the present. Steve Herrett shoots skeet with one of these and does not do at all badly at it.

A further intriguing possibility exists for the Speer shot capsules, if you also happen to be set up for swaging bullets. I refer to the little rodlets of extruded lead left over from the core-swaging operation. These can be packed into the capsules — a rather laborious operation — and loaded in the usual manner. Whether or not they are more destructive than round shot pellets is a moot point, but the havoc they leave in a paper target is impressive. Others have suggested cutting thin brass welding rod into segments of appropriate length and packing them into the Speer capsules.

I refer to such things as *langrel loads*. In the days of muzzleloading cannon, a load of langrel consisted of substituting pieces of chain, cable and any handy ironmongery for the round cannonball. Used at close range in naval encounters, langrel loads made effective havoc against the

enemy's sails, rigging and sniping marines posted up in the shrouds. Some dictionaries give the modern term for that as *langrage*, but I much prefer langrel, myself.

The .41 magnum is about the only major caliber for which shot capsules are not readily available, but there's a way around that, too. Size, prime and add a suitable charge of powder to the case, then insert the base of a .410 plastic cup wad into the mouth. Add a judicious amount of shot, allowing it to build above the case mouth a bit. Press a .38 bullet jacket down over the shot, put it through the seat/crimp die to perform a generous crimp, and trim away the excess plastic with a single-edge razor blade. Keep the overall length short enough to be contained within the revolver cylinder, of course. Such loads work surprisingly well and the pattern spread isn't too bad.

BBM Corporation now has their Hardcap load in .45 ACP and expects to have a 9mm Luger version on the market shortly. This is a shot load with the pellets enclosed by a round-nosed cap similar to a bullet jacket. Externally, it resembles a conventional round of hardball ammo. Unlike all the other shot cartridges for handguns, the BBM hardcap has enough vim and vigor to work the action of an auto pistol. As a result, you can fire up to eight rounds in the M1911-type Colts as rapidly as you can work the trigger. BBM hopes to offer the Hardcap components for use by reloaders at such a time as it becomes practical.

J.D. JONES ON WILDCATS

**This Renowned Handgun Hunter Knew
What He Wanted, And Managed To Get It!**



J.D. Jones with a 2000-pound eland taken with the JDJ Handcannon he's holding. He notes that the wrist band he's wearing here, with loops for spare cartridges, sometimes makes the hand swell, if it's too tight.



Jones with an elephant stopped in full charge by the .375 JDJ Handcannon.

(I had asked J. D. Jones for his thoughts and comments on the JDJ line of wildcat cartridges and he found time in his busy schedule to come through with it. The rest of this chapter are Jones' own words. The usual disclaimer applies to the load data he quotes: Since neither Jones, DBI Books, nor I have any control over equipment, components and techniques used by others in reloading, we cannot and do not assume any liability, express or implied, for any damage or injury arising from or alleged to have arisen from the use of such data by others. I also want to add that if you decide to hunt elephants or smaller game with a handgun and suffer fatal footprints or other mishaps, we're not responsible for that, either! — D.A. G.)

AT THIS point you should have figured out who designed the JDJ series of cartridges and that I'm prejudiced in regard to them. Right, prejudiced in favor of power and accuracy when it comes to killing animals efficiently. That's what the JDJ series of cartridges is designed to do — kill efficiently. The fact that some of them are also excellent target cartridges is simply a secondary benefit.

The efficiency of a cartridge means a wide variety of things to shooters. Some try to equate or create formulas to define the efficiency of a particular cartridge in relationship to another. That's all well and good, and gun writers need something to write about and shooters need things to read about. Velocity, energy, 25 grains of powder rather than 30, X foot-pounds of energy (fpe) per grain of powder used and efficiency by any definition make interesting reading and comparisons. I'll confess to having spent a lot of time making comparisons of such nature.

Those comparisons and my experiences in the field actually harvesting a wide variety of game have led me to my own definition of cartridge efficiency. That definition is simply one that says to use one that kills the best. I don't

really care how many fpe a bullet has and certainly don't subscribe to the theory that a bullet must "expand, and stop inside the animal thereby expending all of its energy within the animal." In defense of those statements let me say that a knife in the heart is worth a hell of a lot more than 10,000 fpe in the butt of most big-game animals. Wishing for a bullet that will give adequate penetration to the vital organs of a deer from any angle and not exit the same animal on a simple broadside lung shot is pure wishful thinking. Using the bullet that doesn't exit a deer on a lung shot on an elk is pure folly. It just doesn't happen in real life. When I see a perfectly expanded bullet recovered from a broadside shot on a whitetail I consider that particular cartridge/bullet combination a failure even though the animal may have dropped as if struck by lightning.

Take the same situation a little further. Instead of hitting the deer through the lungs and taking out the major arteries exiting the heart causing an instant total loss of blood pressure, immediate irreversible shock and practically instant death; assume the bullet struck a stomach full of browse, expanded and stopped with thirty pounds of semi-digested browse absorbing the bullet's entire energy. The deer then presents a going away shot. Eight inches of penetration won't get the job done from the rear. Thank you, I'll take a bullet that will give the biggest hole I can get ALL THE WAY THROUGH about ninety percent of the time. Blood leaks out and air goes in a lot quicker through two holes. This results in quicker death of the animal and faster recovery under most field conditions. The ten percent that don't get complete penetration will be due to hitting massive bones or lengthwise shots. The old adage, "Don't send a boy to do a man's job," applies well to selecting a cartridge/gun combination for big game.

The fact that few handgun cartridges existed that would give that kind of performance led to the design of the JDJ series of cartridges, bullets and the tools to use them.

If you want effective, versatile performance from a handgun you can't settle for anything less than a single-

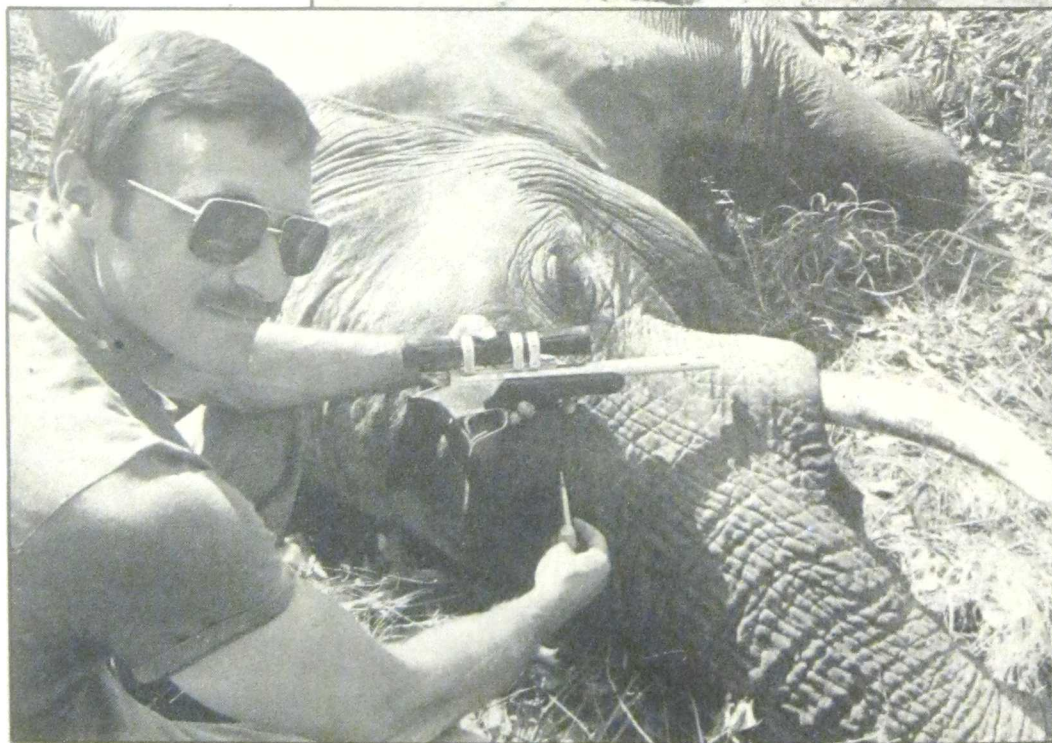
shot. The Thompson/Center Contender is the best and most versatile hunting handgun in the world. The custom large caliber XP-100 conversions run second.

At this point there is no repeating handgun that will come close to matching the T/C in accuracy, penetration, long range capability, versatility or sheer power. There is also the mystique of hunting with a single-shot that is unlike anything else. Ever notice how the guys that rely on repeaters sorta apologize for using them with some statement to the effect that they wouldn't be caught without the capability of "a quick follow-up shot"? The guy who shoots a

single-shot is not an insecure type! He is probably a good hunter and good shot who knows when and when not to shoot. He also uses enough power with his first and usually only shot.

The .30 and .357 Herrett T/C cartridges were the ground breakers into the area of high performance handgun hunting cartridges. Good as they are, they suffer from the problem of having to use relatively weak .30-30 cases and a case capacity that requires fast-burning powders and lightweight bullets for their diameter to be used to achieve reasonable velocity. They do, however, leave the straight-

Mark Hampton dropped this Cape buffalo with the .375 JDJ on a frontal chest shot. The animal weighed about 1600 pounds.



Hampton dropped this young bull elephant instantly with a frontal brain shot. Bullet was a 300-grain Hornady solid from a 12½-inch .375 JDJ Contender.

wall pistol cartridges in the dust when it comes to long-range killing power and accuracy. At one hundred yards or less, the .44 magnum is far superior to them if loaded right and the game is big, requiring a lot of penetration.

The JDJ cartridges are the result of the failures and shortcomings of the others. They solve the problems nicely. They aren't perfect and are compromises in many areas of cartridge design, as are all cartridges. For example, you simply do not design the throat of a cartridge for benchrest the same way you do for a hunting cartridge.

First consideration should be given the gun. Fact: the T/C operates faster and easier with rimmed cartridges.

Second consideration should be given the cartridge case. The .225 Winchester and .444 Marlin are the strongest rimmed cartridge cases readily available and of the approximate correct capacity for their practical possible bore diameters for use with tough, long bullets designed to retain their velocity well and penetrate deeply.

Third consideration should also center around the cartridge case. How easy is it to form? Will it form radical forty-degree shoulders without unacceptable loss? Will it expand up or neck down without collapsing, wrinkling the neck or splitting? The only way to answer these questions is to have a reamer ground, dies made, put a gun together and start shootin'! That takes money and time. It is also the point where most would-be wildcatters lose interest.

Fourth consideration, obviously in consideration of the others, is to figure out what you want the cartridge to do. In

the case of the JDJs, the hunting role was already defined.

Fifth consideration, or thereabouts, should define the heaviest bullet to be used in the cartridge and the normal bullet to be used. A decision must then be made as to the throat of the chamber to come up with a proper fit. I prefer a fairly long jump from case to rifling in hunting cartridges to assure lower initial pressures and case head thrust, as well as easier engraving of the bullet by the rifling, which is an important consideration if you intend to use steel-jacketed solids.

If you get this far it's time to get to work. I prefer to work with forming sample cases, if I can, or at least forming them to the point of having a round ready for fire-forming.

It's common knowledge that the sharp forty-degree shouldered, almost straight-walled cases deliver the highest velocities with the least case head thrust; an important consideration in dealing with the Contender action. It simply means you can get more power out of this case shape in the Contender.

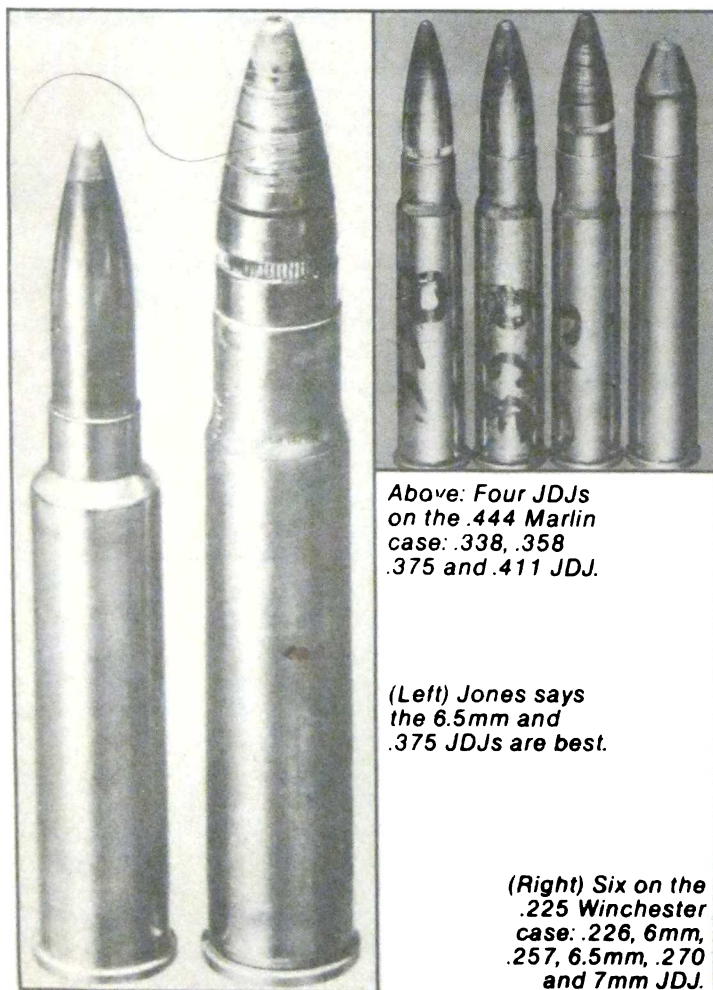
The .225 Winchester case is an excessively tapered soft-shouldered .22. It had to be straightened out, given a sharp shoulder and maximized for case capacity. That meant ending up with a short neck which scares some unknowledgeable people. The neck is simply a bullet holder. As long as it's straight and strong enough to hold the bullet securely that's all it needs. I can't see that it has anything to do with anything else of a practical nature as long as it meets this criterion. At least I don't think a longer neck would have improved the under one-half-inch, two-hundred-yard groups that routinely turn up in random testing.

Essentially the 6.5 and 7mm JDJs were the first JDJs put together on the .225 case, and the .375 JDJ the first on the .444.

Starting with the .226 let's take a quick look at each.

.226 JDJ

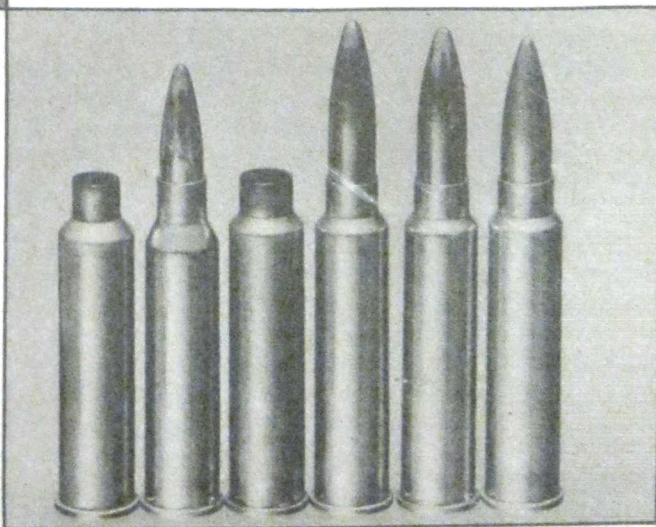
This is simply a fire-formed .225 to a larger or improved shape giving greater powder capacity. I do not advise firing .225 factory ammo as its pressures are quite high for the Contender. The idea behind this one is to give heavy bullets higher velocity than they can be given with the .223.

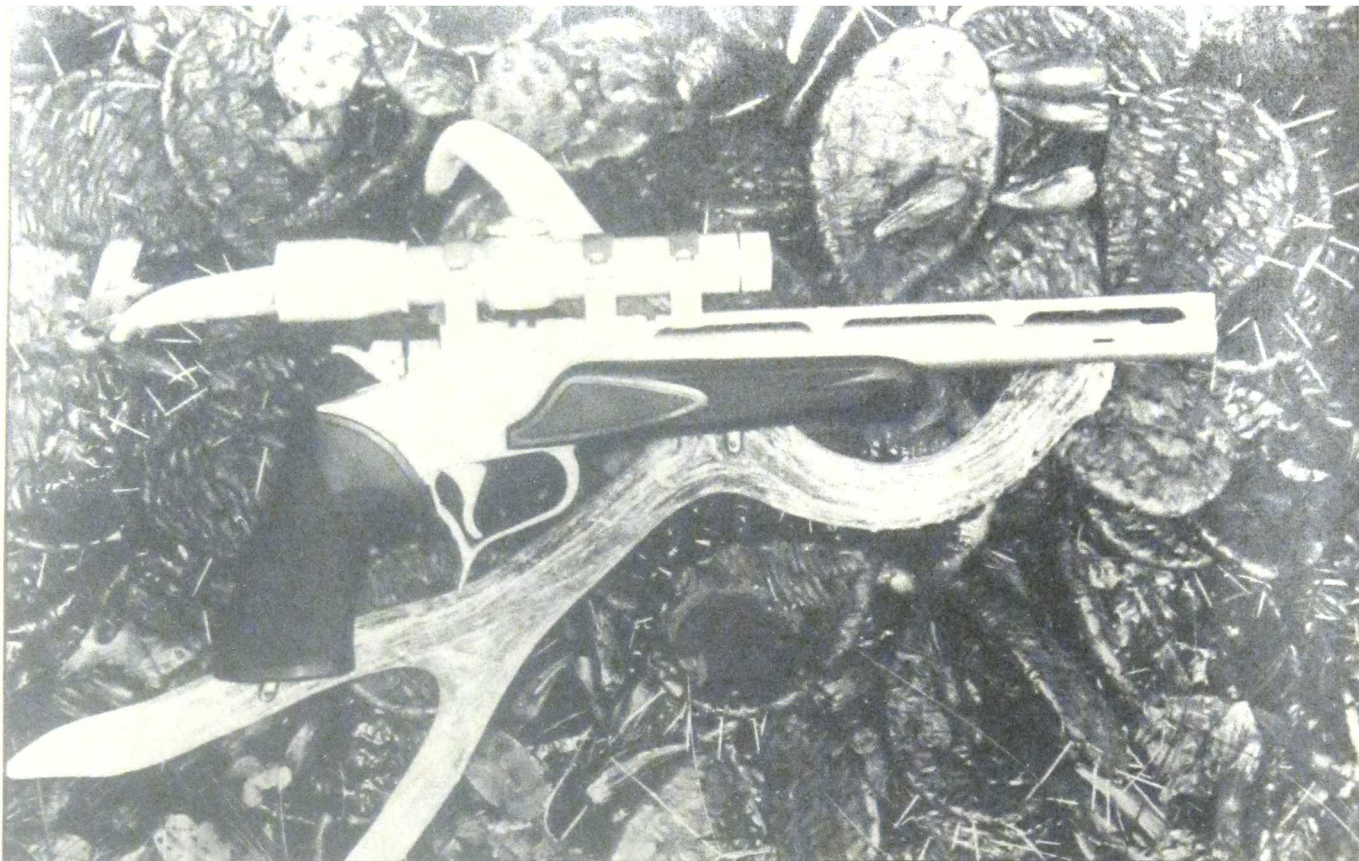


Above: Four JDJs on the .444 Marlin case: .338, .358 .375 and .411 JDJ.

(Left) Jones says the 6.5mm and .375 JDJs are best.

(Right) Six on the .225 Winchester case: .226, 6mm, .257, 6.5mm, .270 and 7mm JDJ.





A typical SSK Contender chambered for the .357 JDJ has a 12½-inch barrel with a full-length vent rib TSOB scope base, SSK Khrome finish and a scope. Mag-na-port vents dampen muzzle climb and recoil. Jones feels that a rig such as this is capable of taking any animal in the world, when properly used by expert hunters.

It is only worthwhile with 60- to 70-grain bullets. Usual twist rate is nine inches to stabilize the heavyweights. Heavier bullets retain their velocity better, penetrate deeper and buck the wind better. There aren't too many of these around and I don't have much personal interest in it so loading data is limited. Velocities of 2700 fps with the 50-grain and 2600 fps with the 70-grain, are reasonable. The new Sierra 68-grain bullet may well turn out to be the best bullet for this caliber.

From this point on, all of the JDJs based on the .225 case must have their neck expanded to the proper diameter and be fire-formed. Expanding the neck is accomplished by a tapered expanding plug in the full-length resizing die. Dies consist of a normal two-die set and no special technique is necessary nor is case trimming or inside reaming. Case loss during forming any of the JDJ cases is zero. Case life is practically unlimited. I'm still using the same cases I started out with in the 7mm and .375. I'd guess some of the .375s have been loaded at least fifty times. The only unusual aspect of fire-forming the .225s is that after fire-forming, bullets of the appropriate caliber fit the fired case very tightly. This would normally indicate a tight chamber. In the case of the JDJs, it indicates the brass used to form the shoulder is, in part, coming from the case neck. The second firing results in a normal bullet-neck fit of a fired

case. The sharp shoulder design combined with short barrels increases velocity considerably. Chronographing fire-form loads versus the same load in formed cases often results in a gain of up to 150 fps in the formed case. I have an idea case shape is of considerably less importance as related to velocity in rifle barrels than pistol barrels due to the much greater time of the bullet in the barrel and resultant greater burning time of the powder. One of these days, I'll run some tests on this — as time permits, of course!

6mm JDJ

The 6mm is the only one that doesn't have the forty-degree shoulder. The reamer manufacturer made a mistake and I decided to try it. Someday I'll do it up with a forty-degree shoulder in the same configuration as the rest of them and make a comparison. As it is, it is at its best as a varmint cartridge. It's quite good on groundhogs and coyotes with 75- to 80-grain bullets at 2700 to 2800 fps. It shoots flat and is quite accurate with its ten-inch twist. Heavier bullets don't seem to work as well due to expansion problems at long range. I don't consider it much of a deer or antelope cartridge although it will kill them with good hits. It just doesn't hit as hard as the larger bores. The difference is obvious in observing animals being hit.

.257 JDJ

This one gets well into the combination varmint/deer/antelope cartridges. The 75-grain bullets at 2800 fps do well on most any varmint. Most of the 100-grain bullets at up to 2600 fps — particularly the Nosler partition which has a quite fragile nose — do well on medium game such as deer and antelope at up to three hundred yards. The cartridge is up to it, are you? The 120-grain bullets at 2300 to 2400 fps don't do much for me as most of them are too hard. The 100-grain gives far better overall performance than any other weight. The 87s are next.

6.5mm JDJ

In my opinion, the best of the small bore hunting cartridges due mainly to having a wide selection of excellent bullets available from 85 to 160 grains. The lights and heavies are for special purposes. The 120- to 130-grainers are the best. The 120 Speer at 2400+ has taken over one hundred deer and antelope without a failure or recovered bullet. Sighted-in three inches high at one hundred yards, it's dead-on at 250. Penetration is excellent. Most 6.5 bullets were designed for the old 6.5 rifles such as the 6.5x54 and others that operated in the same velocity ranges as the JDJ. The bullets work right. It also does well as a silhouette cartridge. It's a deadly antelope cartridge at

three hundred yards in good hands. The 100-grain bullets at 2600 are favored by quite a few shooters. I personally use the 34.0 grains of 4320 under the 120s for everything.

.270 JDJ

Decent with 130s at 2400 and 110s at 2500. Have to be careful with bullets though. Some are too tough, some too fragile. Frankly, I don't have them all figured out yet. It seems exceptionally accurate with just about anything it's fed. Does well at the silhouette game. The 150s are positive on rams. I've had two bullet failures due to blow-up when striking fairly large bones with the 130 Sierra HP. More field testing is needed.

7mm JDJ

Obviously the most popular due to the general popularity of the 7mm. Does quite well at silhouette. The same things regarding bullets apply to it as the .270. Find the right bullet for the job at hand and it works. The 120- to 130-grain are best for deer and antelope at around 2400+ fps. The 140s and heavier will generally give expansion problems at long range. The 150- to 160-grain are the maximum useful weights for silhouette. Three hundred yards is its maximum antelope range. Has the advantage of full-

J.D. Jones and Mark Hampton with a fine pair of white-tailed gnu taken at long range with the 6.5mm JDJs. Both rank high in the SCI record book and they rank one and two in the Handgun Hunters International book.



metal jacketed 140-grain military surplus bullets being available. They are useful for target and, particularly in Africa, it's nice to have a few in your ammo pouch.

.338 JDJ

Uses the .303 British case opened up to .338 and fire-formed. The .303 case was used because case loss in necking the .444 to .338 in one step was a problem. The .444 can be used, but it's work. I particularly like the .338, but there is little to recommend it over the .358. The .338 bore just isn't popular in rifles, either. The .338 Wildeats in the XP, where higher pressures can be used, beat both the .30s and .358s. The 200- to 250-grain bullets are accurate and penetrate well. I saw Blackie Silva put a 200-grainer lengthwise through an antelope at over two hundred yards a couple years ago.

.358 JDJ

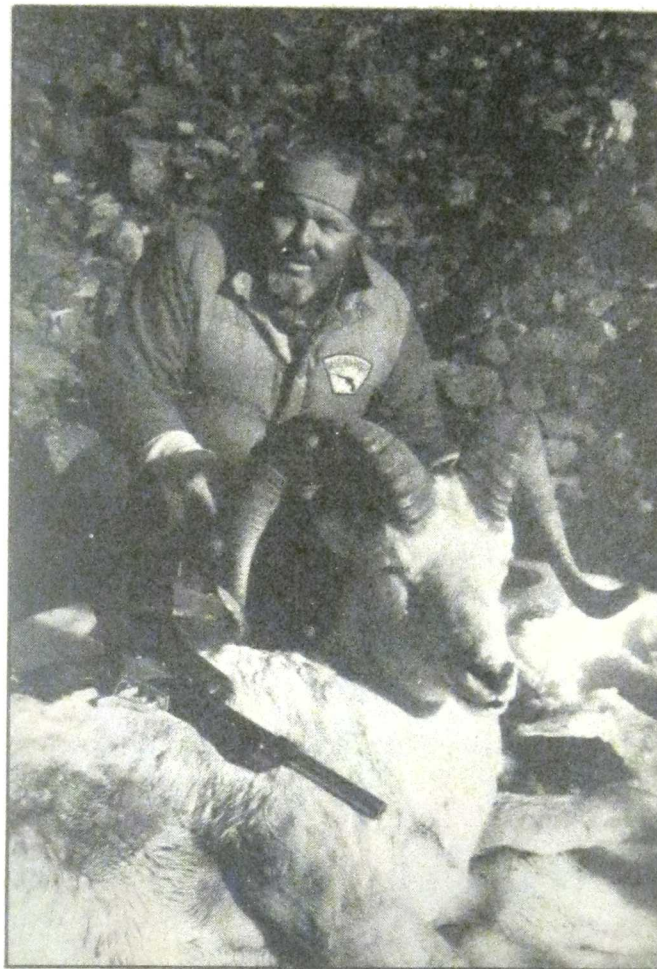
Utilizes the .444 Marlin case necked down in its full-length reloading die. No trimming, reaming or fire-forming required. Just load full charges and shoot them. The .357s, .357 Herretts and .35 Remingtons can be rechambered. I don't think much of it with light bullets. Some of the pistol bullets at high velocity disintegrate in mid-air. The 180 Speer works okay; the 200 round noses drop like a rock at long range and don't penetrate well. The Speer 250 spire point is the best bullet for this one. It will do 1950 fps and penetrates well. It has been used in Africa a fair amount and found to be inferior to the .375. It's a good long-range cartridge for deer and does well on elk with the 250s. Too bad the bullets aren't as good as those for the .375; it would then be a lot more useful on larger thick-skinned game.

.375 JDJ

Best of the lot. Gives prairie dog accuracy and elephant killing penetration without objectionable recoil. The 220-grain Hornady SP at 2150 fps is the best deer bullet and will take them at three hundred yards according to its users. The 270 Hornady Spire point at around 1960 fps is the best all-around big-game bullet and gives exceptional accuracy, penetration and ranging qualities. This has become *the* handgun cartridge for serious big-game handgun hunters. The 300 Hornady SP is the best short-range stopper and the 300 Hornady solid almost always completely penetrates elephants' heads from any angle. I expect any SSK .375 JDJ barrel to shoot 1.5-inch one-hundred-yard groups just dropped into any frame with full-charge hunting loads and a good pistol scope. This cartridge has made the hunting of *any* animal with a handgun a viable option. It just does well everything asked of it. I'd rather have it than ninety-nine percent of the rifle cartridges in existence for dangerous game. The 46.5 grains of H-4895 under any 270- to 300-grain bullet is a superior load.

.411 JDJ

Simply the .444 necked to .41. It really needs good jacketed 300-, 350- and 400-grain bullets. Pistol bullets give good results on deer-size game, but aren't tough enough for the big animals. A jackrabbit hit with a 210-grain HP at 2300 is one of the more spectacular sights in varmint hunting. Some bullets will disintegrate in a gallon paint can filled with water at close range. I have a 300-grain cast



Larry Kelly, head of Mag-na-port and recipient of the 1984 Outstanding American Handgunner trophy, took this Dall sheep in Alaska with .375 JDJ.

bullet that does a good job as far as a cast bullet goes. Some good .41 heavyweights are about to make an appearance, but I can't recommend them until they have been thoroughly tested. I think it has the potential to equal the .375 in general and surpass it in several areas if the right bullets become available.

.430 JDJ

It's a .444 cut back .100-inch. Originally it was for ten-inch barrels and to prevent use of standard .444 ammo, of which some of the old ammo might be loaded quite warm — new ammo is apparently mild. Does just about what the .444 does which isn't too bad. A 265 will get 1900 from a fourteen-inch barrel. It did spur me to design the JDJ line of heavyweight cast bullets for revolvers and T/Cs. The 320- and 360-grain cast bullets are good and highly effective on any American game. Forget cast bullets at velocities high enough for African big game in this caliber. The 320-grain in the .44 magnum revolver or single-shot is the most deadly big-game projectile now available. The 360 is better in the .430s and .444s; .44 mag barrels can be rechambered.

In summation, I'd like to say that a few years ago I founded Handgun Hunters International (P.O. Box 357 Mag, Bloomington, OH 43910) to further the sport of handgun hunting. HHI's publication, *The Sixgunner*, is written by the members. I think it's had some effect on the sport and new members are solicited. It has given information of great value in assessing the effectiveness of a cartridge the right way — in the hands of the ultimate user. In addition, I hunt about anything, anywhere, anytime I can and have been doing so for more years than I like to admit.

My primary employment is SSK Industries (Rte. 1, Della Drive, Bloomington, OH 43910) which is engaged in the manufacture of and marketing of custom T/C barrels, T'SOB scope mounting systems for handguns, custom XP conversions, .41 Avenger conversions for the 1911 Colt and other handgun related items. At present, we chamber over eighty cartridges in T/Cs.

Obviously, I can shoot whatever gun or caliber I want to and, from a financial standpoint, it doesn't make a bit of difference what chamber is in a barrel that I sell.

It does make a difference to me that a customer selects the best tool for his job. Two of the JDJ cartridges will do anything from long-range varminting to stopping elephants.

The 6.5mm and .375 JDJ will do it all. The 6.5mm has been well proven to be effective on animals including mule deer. I've just returned from Africa where several of us experimented with the 6.5 on bigger animals, too. Mark Hampton and I took twelve animals ranging in size from springbok (fifty pounds) to Cape hartebeeste (450 pounds) at from 220 to 304 paces with fourteen shots. Mark's hartebeeste was a 269 and mine at 279. Both were dropped in their tracks instantly with shoulder-spine shots with a single 125-grain Nosler partition bullet. One finishing shot was taken as neither of us let anything lay around waiting to die so we can say it was a one-shot kill. My white-tail gnu was taken with a shot that entered the front of the near shoulder and exited the body cavity through center lung on the far side. He was down and dead in fifteen yards. The longest shot was 304 yards on a springbok. It was a heart shot and he was cleanly taken. I don't recommend the 6.5mm for four-hundred-pound-plus animals, but it will take them if you can shoot and know where to shoot them. It just isn't enough gun for the big guys unless you have frontal or broadside shots. Sighted-in three inches high at one hundred yards, it's about dead-on at 250.

The .375 JDJ will take them from any angle. On truly big game you can trust the .375. Load it and shoot it right, and it'll take care of you. Ray Guarisco, Mark Hampton and I took four elephants, three Cape buffalo and a lion on this trip. Ray took one of the elephants with the .45-70 SSK Contender, the rest fell to the .375. Mark and I both shot our buffalo with frontal chest shots. Both 300-grain solids stopped in the stomach. Mine went eighty-five yards before he cashed in. Ray shot his broadside. Shot it three times. All of them went all the way through. He also lung-shot an elephant. The 300 solid was stuck in the skin on the far side. (Bob Good reported the same experience.) Mark brained his elephant with a frontal shot and the bullet was lost during the ensuing party fifty-plus natives had with the meat. I had the good fortune to be charged by an elephant.

At about eighteen steps, as it was reaching out with its trunk, the 300 solid entered the trunk about a foot below eye level, stopping it instantly and ending up about ten to twelve inches behind the skull and just slightly higher than the top of the spine. It's one of my more memorable moments in hunting. Mark nailed his running lion through the heart with a 270 spire point. I took a bushbuck at 350 yards with the same load.

Yep. I'm prejudiced. That's why.

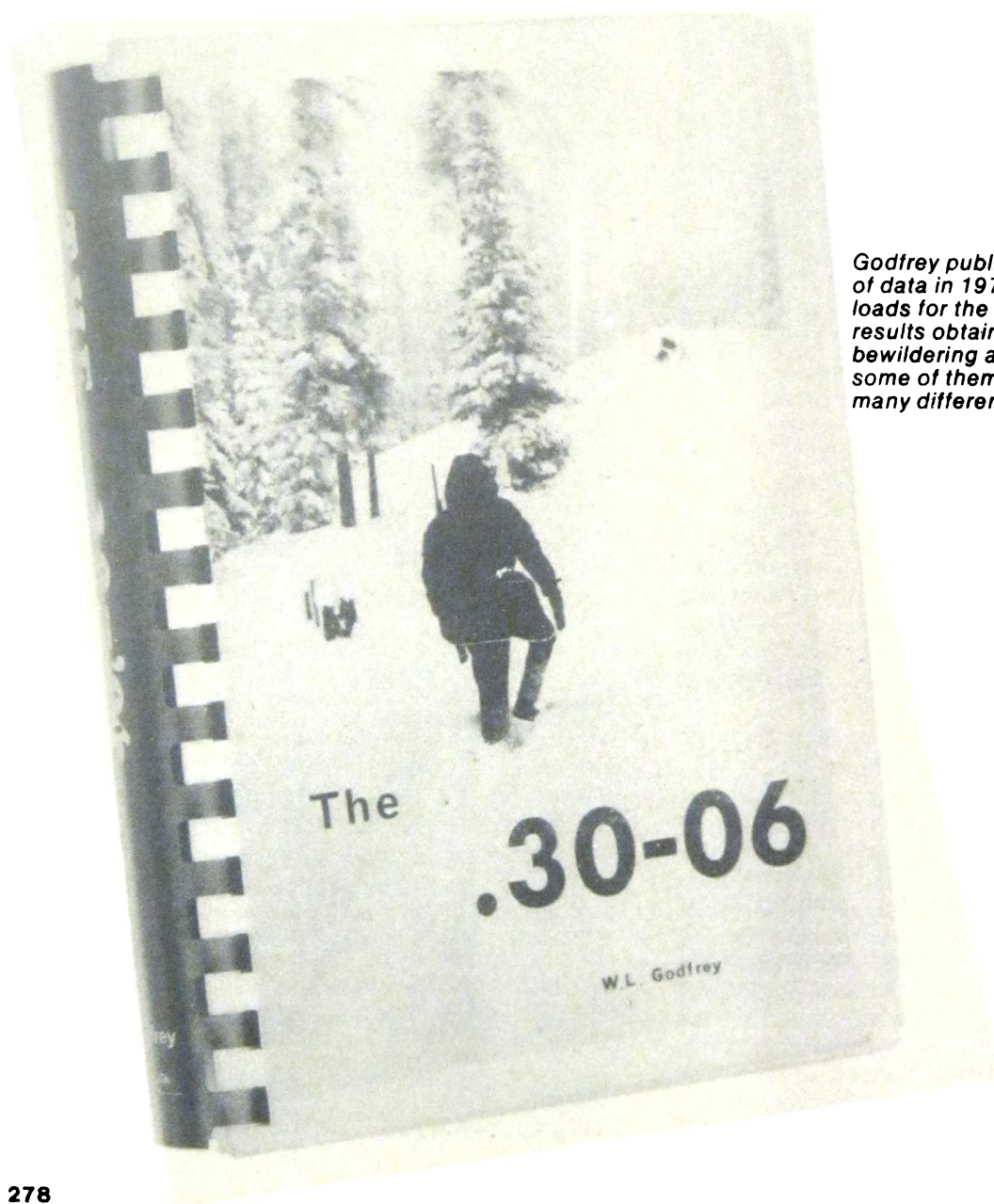
SAMPLE LOADS

Cartridge	Bullet (grs)	Powder (grs)	fps	fpe
.226 JDJ	63 Sierra	38.0 H4831	2815	1109
.226 JDJ	60 Hornady	32.0 N202	2910	1128
.226 JDJ	60 Hornady	32.0 3031	2865	1094
.225 JDJ	60 Hornady	33.0 4064	2842	1076
6mm JDJ	60 Sierra	32.5 3031	3048	1238
6mm JDJ	60 Sierra	35.0 4064	3055	1244
6mm JDJ	75 Sierra	30.5 3031	2750	1260
6mm JDJ	75 Sierra	33.0 4895	2755	1264
.257 JDJ	75 Sierra	35.5 3031	2860	1363
.257 JDJ	75 Sierra	38.5 748	2830	1334
.257 JDJ	87 Hornady	35.0 3031	2705	1414
.257 JDJ	87 Hornady	37.3 4320	2775	1488
.257 JDJ	100 Hornady	34.0 3031	2640	1548
.257 JDJ	100 Hornady	35.0 4320	2660	1572
.257 JDJ	120 Hornady	33.0 748	2307	1419
6.5mm JDJ	100 Hornady	35.5 4320	2640	1548
6.5mm JDJ	120 Speer	34.0 4320	2504	1671
6.5mm JDJ	129 Hornady	33.0 4320	2380	1623
6.5mm JDJ	140 Sierra	32.8 4320	2340	1703
6.5mm JDJ	140 Sierra	35.0 4350	2141	1425
.270 JDJ	110 Hornady	36.5 4320	2540	1576
.270 JDJ	110 Hornady	35.0 3031	2538	1574
.270 JDJ	1130 Speer	35.0 4320	2415	1684
.270 JDJ	130 Speer	36.0 748	2327	1563
.270 JDJ	130 Speer	34.0 3031	2410	1677
.270 JDJ	140 Hornady	34.0 3031	2284	1622
.270 JDJ	150 Hornady	36.0 4350	2115	1490
7mm JDJ	120 Sierra	34.0 H4895	2480	1639
7mm JDJ	120 Sierra	35.0 H322	2466	1621
7mm JDJ	139 Hornady	34.0 4320	2145	1420
7mm JDJ	154 Hornady	34.0 4320	2107	1518
.358 JDJ	250 Speer	48.0 4064	1959	2131
.358 JDJ	250 Speer	46.0 H4895	1939	2088
.358 JDJ	250 Speer	44.0 H322	1920	2047
.375 JDJ	220 Hornady	40.0 4198	2147	2252
.375 JDJ	270 Hornady	44.0 3031	1893	1751
.375 JDJ	270 Hornady	46.5 H4895	1960	1877
.375 JDJ	300 Hornady	46.5 H4895	1931	2485
.411 JDJ	210 Sierra	40.0 4227	2150	2156
.411 JDJ	295 Cast	45.0 H322	1683	1856
.411 JDJ	318 Cast	47.0 4064	1680	1993
.430 JDJ	265 Hornady	38.0 4227	1950	2238
.430 JDJ	320 Cast	42.0 H322	1599	1817
.430 JDJ	360 Cast	42.0 H322	1606	2062

RECOMMENDED REFERENCES

Books That Provide Additional Details,
With Particulars On Where To Get Them

Godfrey published his first compilation of data in 1975, restricting coverage to loads for the .30/06 and reporting the results obtained with a vast and rather bewildering assortment of powders — some of them quite unlikely — behind many different weights of .308 bullets.



IN A FEW of the preceding books, I've committed unfortunate gaffes by mentioning books I held to be helpful and then failed to provide clear-cut chapter and verse as to where such wondrous works could be obtained. I propose to rectify that booboo in the chapter at hand.

I had discussed two books by W.L. Godfrey, titled *The .30-06* and *.243 & 6mm*. Both books, be duly advised, are published by and are for sale from Elk Mountain Shooters Supply, Inc., 1719 West Marie, Pasco, WA 99301. You had better drop them a postcard first, quizzing as to the price plus shipping and handling. As with all things, prices of the books tends to move upward in step with inflationary spirals.

The first Godfrey book is titled *The .30-06* on the cover and *The .30-06* on the title page inside. Our customary house style makes it .30/06 and my personal preference would be for .30/'06, but that's no big federal case.

Scanning back over the introduction to *The .30-06*, as written in January 1975, it mentions that books were contemplated similar to this one on the .243 Win. and the .38 Spl.-.357 mag. The one on the .243 did, in fact, appear. The one on the .38/.357 has not yet done so to the best of my knowledge.

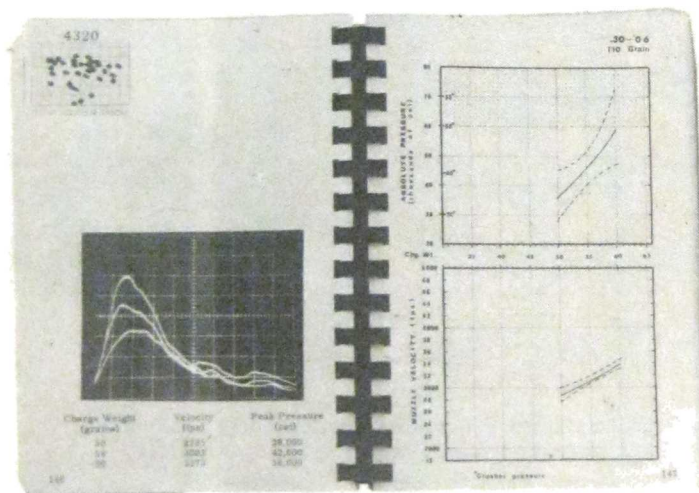
The Godfrey books — both of them — are not your typi-

cal Reloading/Handloading Manuals/Handbooks; not by a long country mile! They are exhaustive compilations of raw data, of potential interest and benefit to the reloader with a broad background of experience and expertise. The listed loads are not necessarily recommended loads. Rather, they show the cathode ray tube traces when all manner of unlikely weights of projectiles are fired with charges of powder that are at least equally unlikely.

Thus in *The .30-06*, it starts off with a 50-grain bullet, driven by charges of Winchester 748 powder and the brief note that, "Both pressures and velocities are very erratic."

Apparently, Godfrey had access to a fairly sophisticated setup consisting of a pressure transducer hooked to a cathode ray tube (CRT) and employed it to try out just about every available powder behind every weight of bullet from 50 up to 300 grains. With the 150-grain bullet, the listing for Hodgdon 5010 powder follows that for WW 230 powder; certainly a seven-league leap. Both powders are now obsolete, but they lie at opposite ends of the burning-speed spectrum: 5010 was ultra-slow, 230 a fast-burning number for target loads in pistols.

Speaking personally, I've always found both books intensely fascinating. It is a body of data absolutely unavailable anywhere else. Whether or not the book on the .38 and .357 ever sees print is a moot point. I hope it does and I



This is a typical set of pages from the Godfrey book on the .30/06, covering use of Du Pont IMR-4320 with 110-grain bullets. One should not load 60.0 grains, mindful that the Speer #10 Manual shows a maximum of 57.5 and the #3 Hornady Handbook a top of 56.2 grains. Study the notice below thoughtfully in that regard!

This notice appears early in Godfrey's book on the .30/06 and seems to imply that some of the top loads listed are much too intrepid to emulate. I'd certainly interpret it that way, at any rate!

This book is not a reloading manual per se which recommends any particular loads or components, or suggests that any particular combination will yield any specific result.

This book is rather a collection of data developed during the course of experiments conducted by Elk Mountain Shooters Supply, Inc. and is warranted only to be a true report of those results. Data are presented which are well beyond "typical" reloading figures for the purpose of studying trends and for help in further understanding the complexities of internal ballistics. It is for these reasons that the book is not sold, offered or suggested for use as anything but a reference book.

It is strongly urged and assumed that the reader will first digest the discussion found throughout the book before attempting to use or duplicate any of the data, to ensure appropriate application

hope to put hands upon a copy. To the beginning reloader, I do not recommend either of these books. They are composed of unedited test data and they can get you into trouble if followed unwisely.

PET LOADS, by Ken Waters.

I mentioned this book in an earlier work published by DBI Books, noting it was put out by Wolfe Publishing. I got some number of pained inquiries from readers, saying they had striven in vain to track down the whereabouts of Wolfe Publishing. Let me note here that that's the enterprise run by Dave Wolfe, out of Box 3030, Prescott, AZ 86302. They put out two bimonthly magazines, called *Handloader* and *The Rifle*. Apart from the publication that pays my regular salary, I regard those two as the next-best to be had. If you like the book at hand, you'll love *Handloader* and will probably dig *The Rifle* to almost equal depth. That is a gratuitous but sincere plug, for what it may be worth.

Ken Waters, it pains me to confess, probably knows more of the intimate ins and outs of handloading/reloading than I do, for the simple but inescapable reason that he gets to do more of it and doesn't have to waste as much time picking nits as I do in the normal flow of time across the calendar. He is also, imho, a nice guy and a valued friend of mine. His book, *Pet Loads*, is a great work and one to which I refer almost as often as Ken Waters does, himself. Write to Wolfe Publishing, at the address given, asking as to the current price and order a copy. I'm pretty certain you'll regard it as a good investment.

Waters seems to be a rifleman first, dipping into handguns as a secondary pursuit. I am somewhat vice versa to that. I suspect I've greater familiarity with the .38 Colt Super than Waters has, but I'd be the first to concede that he knows more about the .225 Winchester than I do. I've never even seen a rifle chambered for the .225 Winchester in all my life to the present, let alone fired a round out of one. Waters, on the other hand, did a fine review of it in *Handloader* of May 1972. On the other hand, he probably hasn't fired as many rounds of .38/45 Clerke as I have. To each his own, and all that. All seriousness aside, I recommend that interested readers check out Waters' book and please don't write to ask me for the address of Wolfe Publishing anymore.

COMPLETE GUIDE TO HANDLOADING

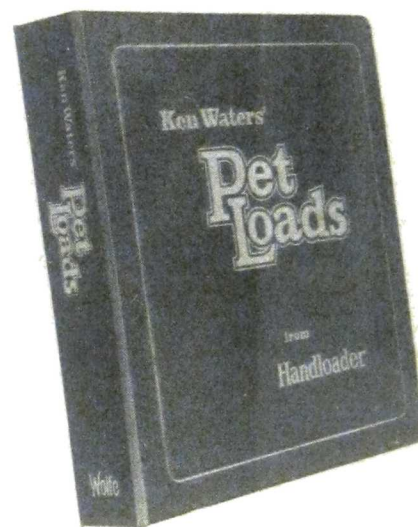
by Philip Sharpe

Despite the antiquity — the last edition appeared about 1952 or so — this still remains one of the exhaustive, bed-rock data sources of all time. I would not take any offer a sane person might make for my last copy if I couldn't get another and I certainly wouldn't sell my last copy to a demented person. True, it contains some information no longer of much pertinence — the tonnage production figures for picric acid by the various arsenals in WWI, for example — but a lot of the coverage is as valid today as when Sharpe put it onto paper, all those many years ago.

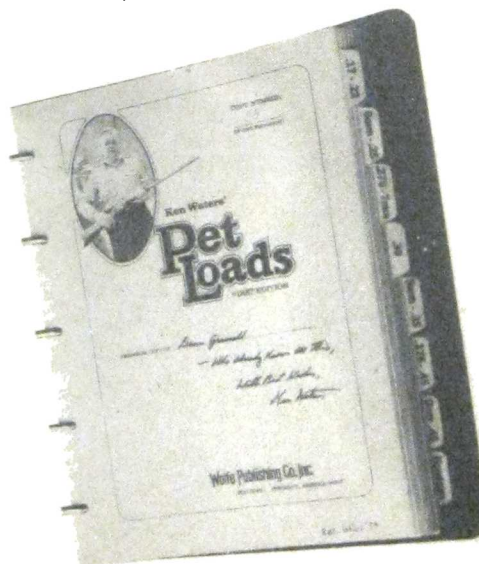
He was, in his own way, the pioneer in this particular field. Others had written about reloading/handloading, but Phil Sharpe went about as far as he could go, at the time he wrote it. Many of the components he lists have been off the

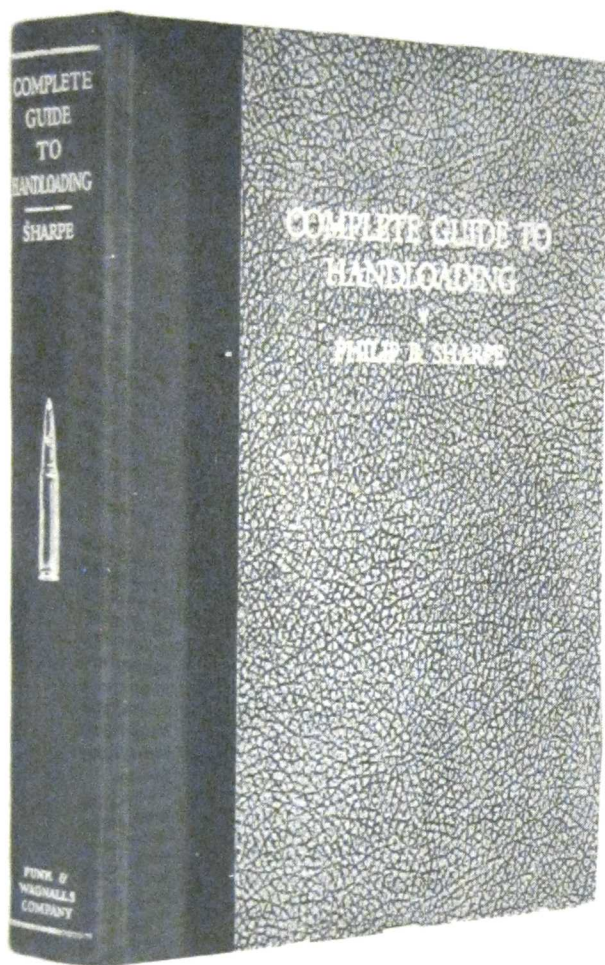


Much the same observations apply to this book as to the one on the .30/06 noted on the preceding pages.



Waters' book is looseleaf bound and supplements are issued periodically to expand and update it.





My personal and extremely well-thumbed copy.

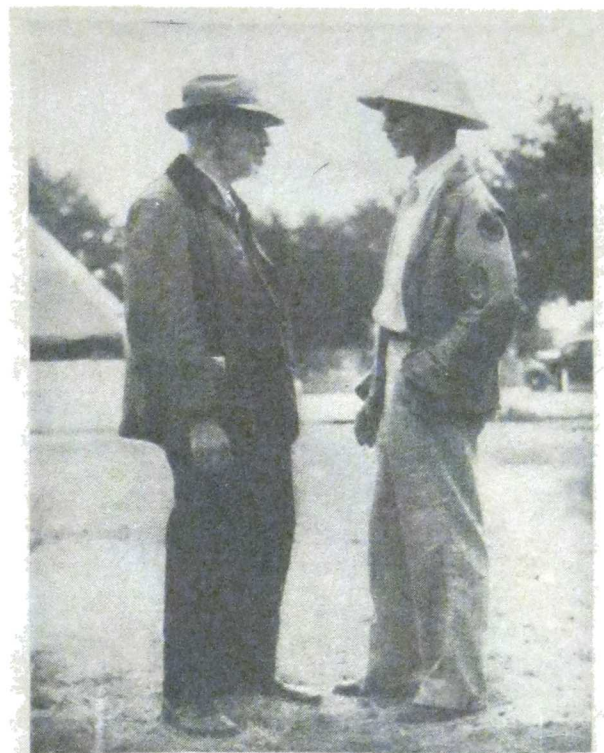
market for a long time now; Sharpshooter powder, to cite but one; Lightning for another.

Nonetheless, if you've any interest in the early days of our absorbing hobby, Sharpe's book is a goldmine of goodly lore. I never had any direct contact with the good gent, myself. He was taken from our midst about the time I first began to take an interest in such matters. Twenty-some years after that, however, I bumped into a man who'd encountered Sharpe when the gent was still around.

It was on the trip to Sweden in the fall of 1974 that our host, Eric Claesson, happened to mention that he'd gone over to the U.S. many years before, to see Sharpe.

"He picked me up at the depot," Claesson recalled, "and as we were riding out to his house, Sharpe asked me, 'Do you like Irish whiskey?' I said I liked it very much and Sharpe said, 'Then we'll get along just fine,' and we certainly did."

Actually, I can confide that Claesson probably prefers the better sorts of bourbon, when it gets down to final choice. At any rate, he filed a wistful request for a bottle of



HARRY M. POPE CHATS WITH THE AUTHOR AT CAMP PERRY. THAT DAY IS FORTY YEARS OLD AND HAS ALWAYS BEEN WORN BY POPE WHILE SHOOTING A MATCH. IT IS HIS "GOOD LUCK" EMBLEM.

Sharpe, right, with Harry M. Pope, in the frontispiece illustration for Sharpe's book.

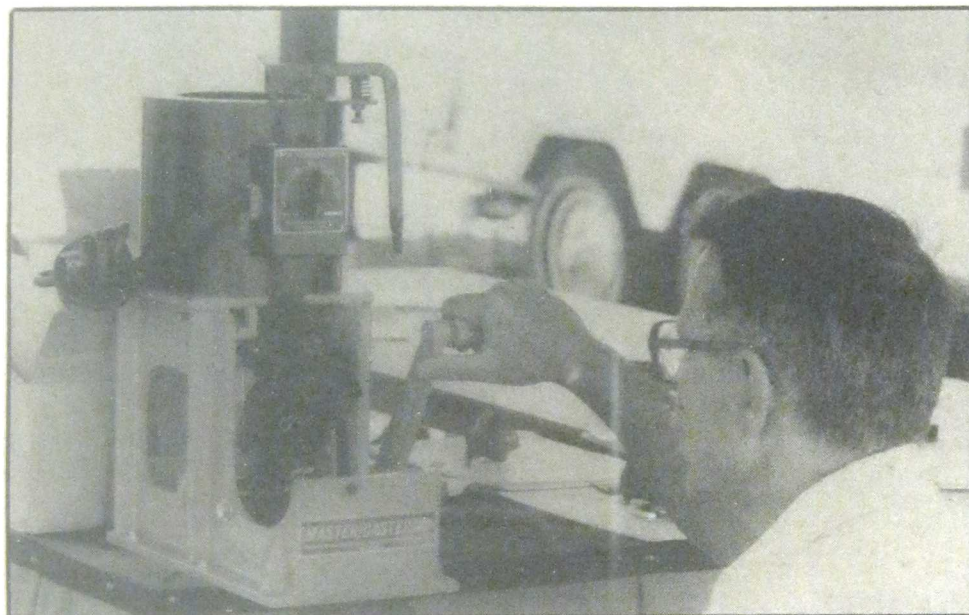
Black-Jack Daniels to be smuggled to him on that '74 trip. The fact remains I'll always regret not having established contact with Phil Sharpe when he was still available. You see, I'm a trifle partial to the dew off the shamrocks, myself. Perhaps, some day — distant, I hopefully trust! — Sharpe and I will stage our delayed *kaffeeklatsch* in some gunwriter's valhalla to chew over endless petty, but pertinent, details of the hullstuffer's arcane arts, with a drap av the craythur to ease the tongues in their waggling.

I feel I know Phil Sharpe better than practically any other person I've never met or corresponded with (never end a sentence with a decimal point!). In all the books concerned with reloading I've done to the present, I've tried to refine and update the words of Sharpe the way I'd want to see it done if I were reading the book in question. I've tried to carry his torch a distance farther and, in this particular field of discussion, you have to exercise a great deal of care where you drop a torch!

How do you put hands upon a copy of Philip Sharpe's *Complete Guide to Handloading*? Well, you could write to the publisher: Funk & Wagnalls, 360 Lexington Avenue, New York, NY 10017. The chances also seem good for obtaining it from Ray Riling Arms Book Co., Box 135, Wyncote, PA 19095; phone 215/438-2456. Or watch for it at gun shows.

LAST BLAST

Final Footnotes To Update The Foregoing



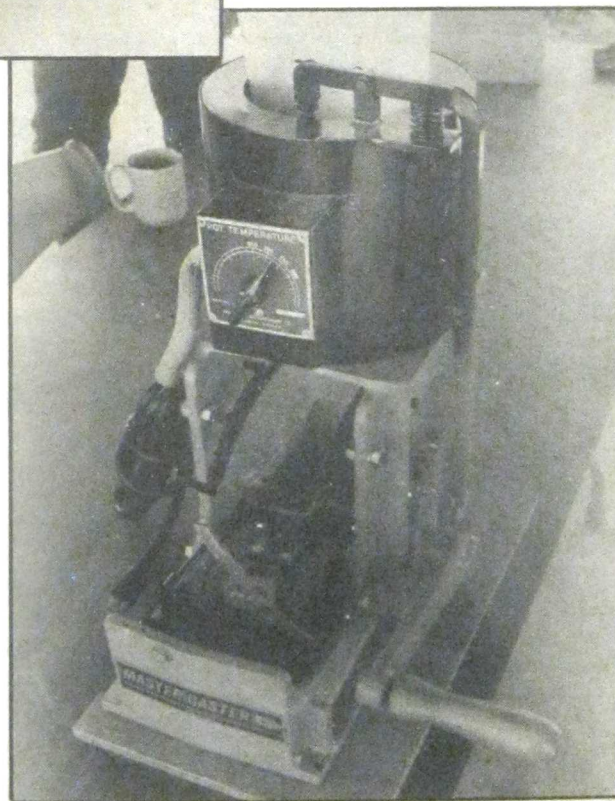
New since this book was started, the Magma Master Caster turns out two bullets per cycle by operating the crank, as Magma's president, Bob Clausen is doing at left. (Below) We see the crank at the end of its stroke, with the sprue cutter swung aside and the blocks parted to drop the bullets into a suitable container.

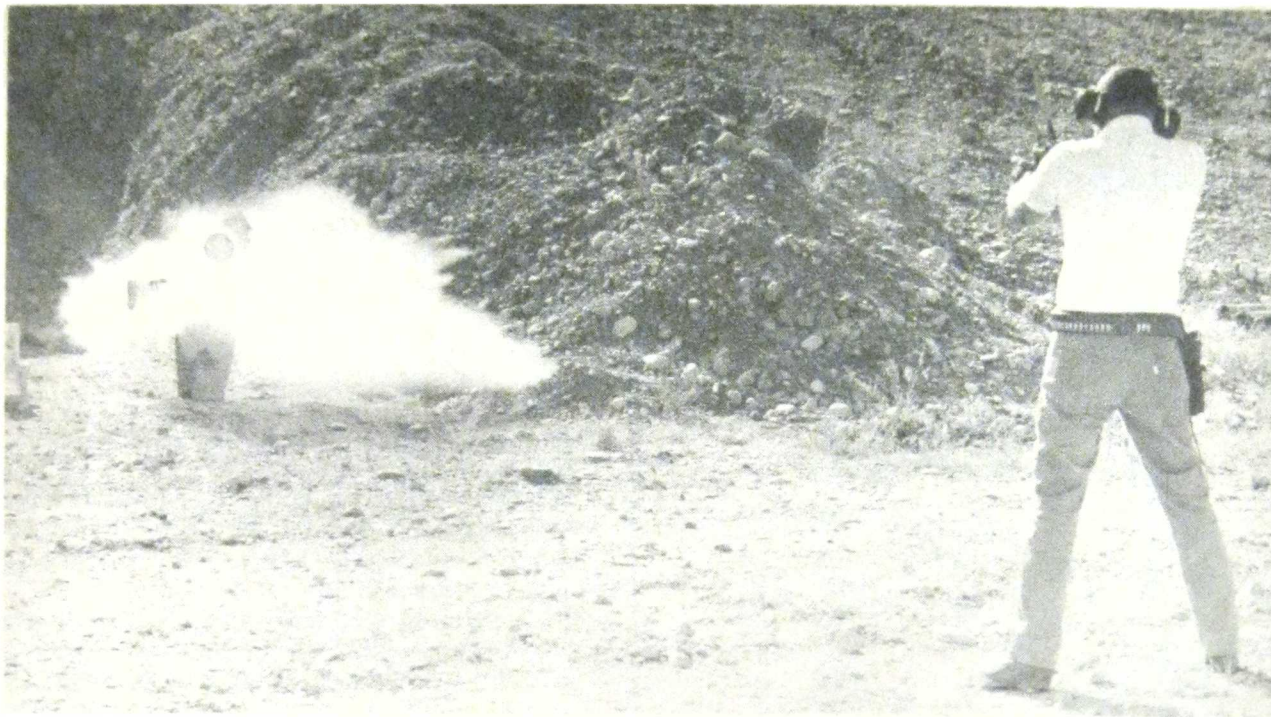
HAVING PRODUCED a moderate number of books such as this, I've learned the need for a sort of cleanup chapter at the end. The field of reloading, like many others, changes endlessly. Thus, a statement made on a certain day may be true when stated, but of no more than dubious validity, even a few days later.

There's a highly illustrative example of that at hand. In terms of real time, it's only been a few weeks since I wrote the copy for Chapter 23 on shotshell reloading. I closed that discussion by emphasizing, in the strongest terms readily available, that one should not attempt to reload shotshells with steel pellets, or even to *think* of doing so.

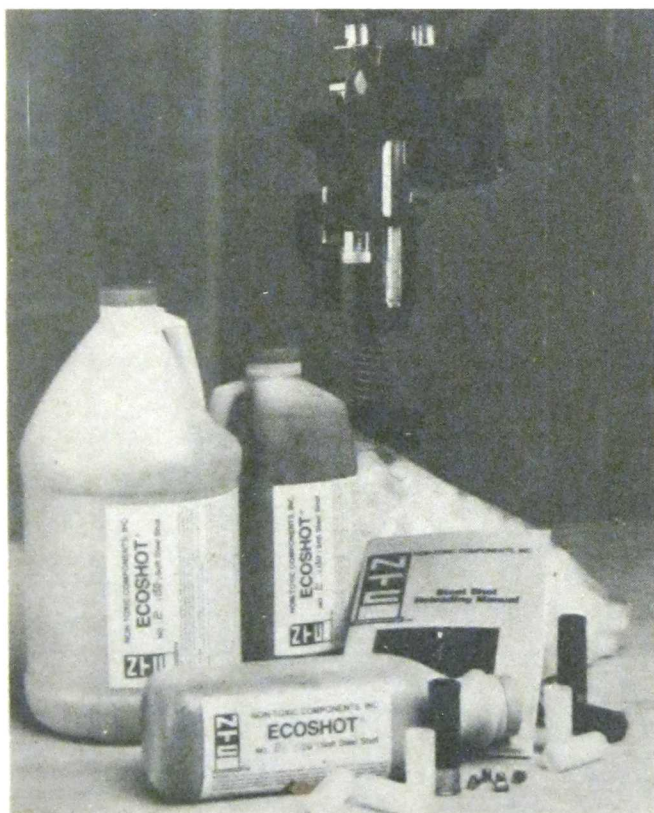
That was the unanimously accepted consensus at the time it was written. Since then, a publicity release came along from a firm called Non-Toxic Components, Inc. (Box 4202, Portland, OR 97208), reporting that they offer kits that enable the reloader of shotshells to turn out steel-pellet loads in a choice of American Standard Nos. 6, 4, 2, 1, BB and the recently introduced T size. The last is .200-inch in diameter, two sizes larger than the BB.

Four sizes of the kits are available, with moderate cost savings on the larger ones. They can be had with 10, 20, 30 or 40 pounds of Ecoshot brand steel shot of the desired size. For each ten pounds, they include 160 especially





Above: Dick Casull shoots a gallon paint can filled with water, firing the .454 Casull at 2510 fpe. The hydrostatic shock smashed the concrete block on which the can was resting! (Left) The NTC kits for reloading shotshells with steel shot, as discussed.



designed wads for use with steel shot. The kit also includes a reloading manual prepared for exclusive use with the NTC components.

The basic kit is said to make it possible for experienced shotshell reloaders to assemble a box of twenty-five shells at a cost of about \$6. While not specifically stated, I'd tend to assume only 12-gauge wads are available at this time.

Please note that I've not as yet seen the NTC kits, let alone had a chance to try them out for evaluation purposes.

Accordingly, I cannot and do not make any personal recommendations regarding their suitability for use, but merely report the availability and source.

Earlier in the book, the Auto-Prime tool from Lee Precision was discussed and illustrated. Since then, I've received a letter from Richard Lee, the firm's president, advising of a potentially serious hazard in using the tool with certain makes of primers.

As was noted, primers in mass are capable of mass explosion and suitable precautions must be taken to guard against the risk of injury if that should happen. According to Lee, the chain detonation of primers by CCI and Winchester is markedly less violent than other primer makes and, for that reason, Lee Precision recommends that only CCI and/or Winchester primers be used in the Auto-Prime tool.

Speaking of shotshell pellet sizes, I had intended to include a chart illustrating the diameter and weight of each but, somehow, it got left out of Chapter 23, so I'll include it here. As we've noted many times, the actual specifications may vary from one maker to another, particularly in the buckshot sizes.

There's a photo in Chapter 14 showing the big automatic casting machine from Magma Engineering Co., Box 161, Queen Creek, AZ 85242. As you might correctly assume, the big gizmos pack a pretty hefty price tag. The same maker recently introduced a simpler, much less expensive design they call the Master Caster. It uses a two-cavity mould block, similar to those for the automatic bullet caster. The single block is mounted on an arm and it moves back and forth about a quarter-turn by means of a hand crank. When the mould is up, a valve lever is operated by

Shot Sizes

No. 12 .05 2459	No. 11 .06 1422	No. 10 .07 895
No. 9 .08 605	No. 8 .09 422	No. 7½ .095 359
No. 7 .10 307	No. 6 .11 231	No. 5 .12 172
No. 4 .13 135	No. 3 .14 108	No. 2 .15 90
Air Rifle .175 55	BB .18 50	No. 4 Buck .24 340 (lb)
No. 3 Buck .25 299 (lb)	No. 1 Buck .30 152 (lb)	No. 0 Buck .32 144 (lb)
No. 00 Buck .34 128 (lb)	No. 000 Buck .36 112 (lb)	

The sizes of shot pellets varies from #12 to #2 by .01-inch for each whole number. Weight up through BB is given in the number of pellets in one ounce.

the thumb of the hand holding the crank, releasing streams of molten alloy to fill the cavities. When the sprues solidify, the crank is moved toward the operator. In so doing, a wing on the sprue cutter pivots it to one side, and, at the conclusion of the stroke, the two halves of the block are separated to release the two bullets. It's designed so the sprues emerge from one opening and the bullets from another, simplifying the return of the sprues to the pot.

Bob Clausen, Magma's president, says that a production rate of around five hundred bullets per hour is not an unreasonable expectation. Quite probably, a small fan to direct a stream of cooling air upon the sprues might accelerate production still further.

Magma has seventeen different designs for cast bullets, plus round ball moulds in fourteen diameters from .237- to .530-inch and Clausen says they can modify most existing mould blocks for use on the Master Caster. Hensley & Gibbs recently added production of two-cavity mould blocks for use with the Magma casters, making all of their many designs available for use with the Magma.

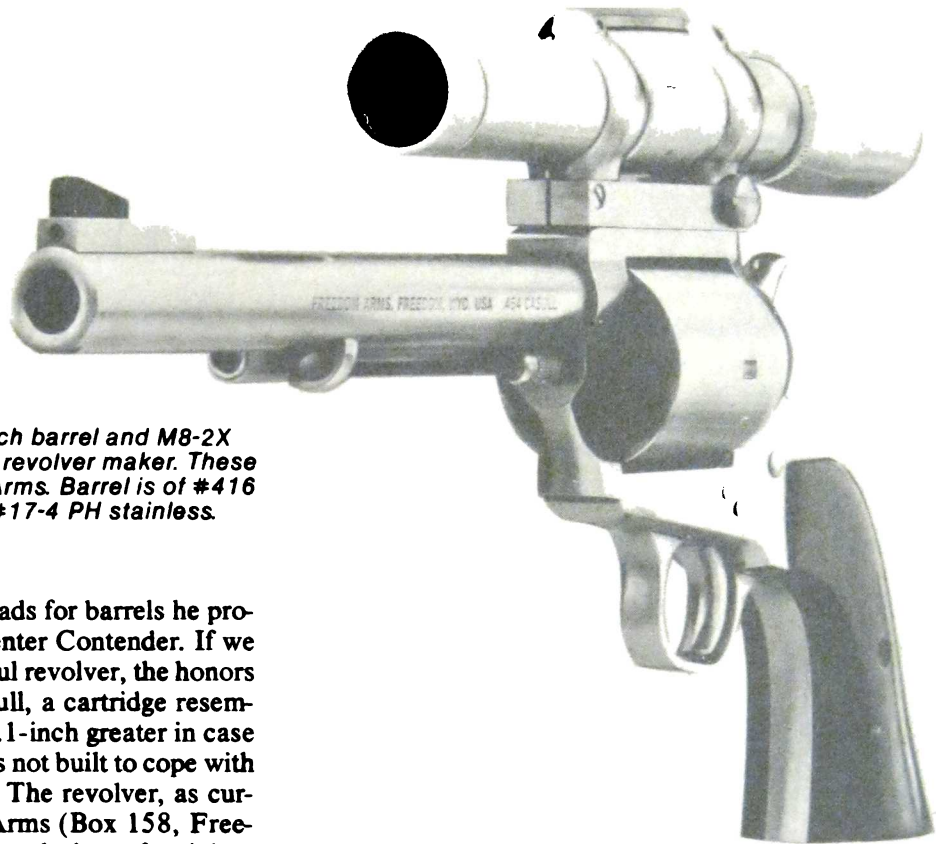
At the time of its introduction, the retail price of the Master Caster was \$497, plus shipping costs on sixty pounds from Queen City. A brochure and further information is available from Magma at the address given.

Accurate Arms Co., Inc. (Route 1, Box 167, McEwen, TN 37101) distributes a growing line of smokeless powders manufactured by Israel Military Institute (IMI) in Israel. Most of these are globular, but some are of the extruded type. Marty Liggins is their ballistician and he can supply brochures covering their current offerings, the name and address of a nearby dealer and recommended load data for use with the powders. I have samples of some of their powders, but have not yet had a chance to work with them extensively. Their #7, for example, is specifically designed for use in the 9mm Luger/Parabellum cartridge and it has given me some gratifying groups in the 10mm Auto cartridge, as fired from the Bren Ten pistol. A charge of 10.3 grains of AA#7 behind the 200-grain Hensley & Gibbs #315 bullet averaged 1182/621 in the Bren Ten and five shots at twenty-five yards grouped to a center-to-center spread of about 2¼ inches. That is a better group than I've been able to get from the factory load to the present and its average performance in 1155/593.

A title that has changed ownership many times is that of "world's most powerful handgun." Elsewhere in the book,



Here are four of the powders in the line from Accurate Arms, currently numbering nine, all together. They include numbers suitable for handguns and rifles.



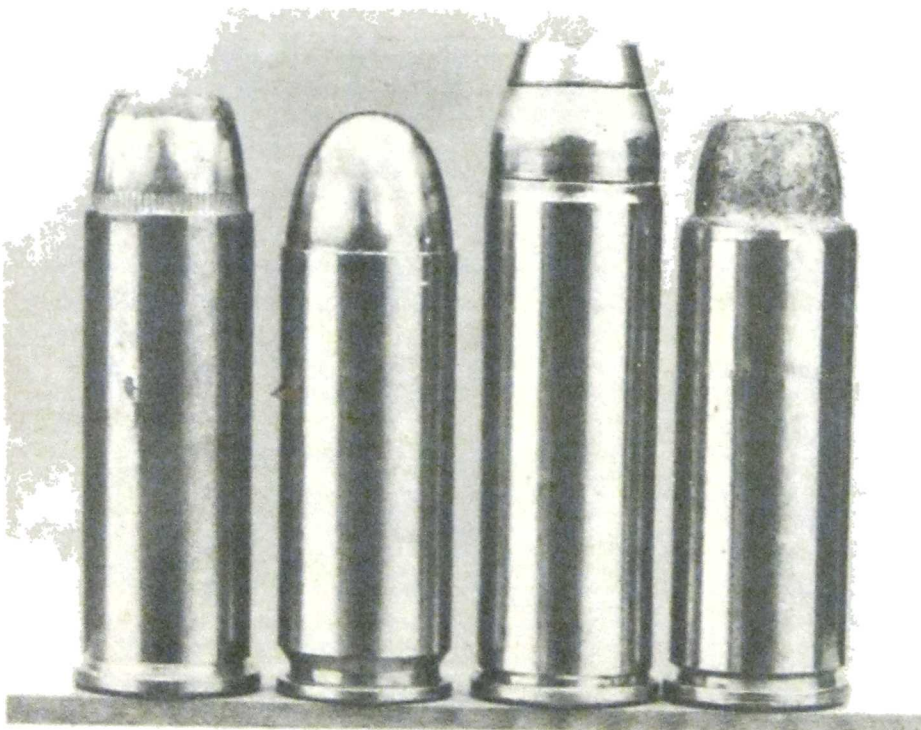
A .454 Casull revolver, with 7½-inch barrel and M8-2X Leupold scope in mount from the revolver maker. These are being produced by Freedom Arms. Barrel is of #416 stainless steel and remainder of #17-4 PH stainless.

J.D. Jones discusses his wildcat loads for barrels he produces for use in the Thompson/Center Contender. If we change that to world's most powerful revolver, the honors quite probably go to the .454 Casull, a cartridge resembling the .45 Long Colt, but about .1-inch greater in case length to prevent its use in revolvers not built to cope with the vigorous pressures it develops. The revolver, as currently in production at Freedom Arms (Box 158, Freedom, WY 83120), is of single-action design, of stainless steel, with a five-shot, unfluted cylinder.

I have had the dubious delight of firing the Casull and the slug ripped through a piece of .25-inch steel plate as if it were soggy Kleenex — striking the plate at an angle of forty-five degrees! Dick Casull, the gun's inventor/developer, photographed me firing it and the muzzle is vertical in recoil, detectably blurred, at a shutter speed of 1/2000-second! The load was a 300-grain JSP bullet at 1941/

2510 out of a 7½-inch barrel. They make their own bullets and use a hardened alloy of lead for the cores.

I'm certain I'll wish I'd added further updating notes here, but we've run out of space for them and the time has come to tie off the discussion until another book comes along. I hope the information offered proves helpful and useful and that you derive as much enjoyment from reloading as I have.



From left: The .44 magnum, .45 Winchester magnum, .454 Casull and .45 Long Colt. The Casull case is identical to the .45 LC, except the case length is increased by one-tenth-inch, as noted in text.

MANUFACTURERS DIRECTORY

AMMUNITION (Commercial)

BBM Corp., 221 Interstate Dr., West Springfield, MA 01089; 413/737-3118 (.45 ACP shotshell)
 Bingham Ltd., 1775-C Wilwat Dr., Norcross, GA 30093; 404/448-1440
 Cascade Cartridge Inc., (See Omark)
 Dynamit Nobel of America, Inc., 105 Stonehurst Court, Northvale, NJ 07647; 201/767-1660 (RWS)
 Eley-Kynoch, ICI-America, Wilmington, DE 19897; 302/575-3000
 Estate Cartridge Inc., P.O. Box 3702, Conroe, TX 77305; 409/539-9144 (shotshell)
 Federal Cartridge Co., 2700 Foshay Tower, Minneapolis, MN 55402; 612/333-8255
 Frontier Cartridge Division-Hornady Mfg. Co., Box 1848, Grand Island, NE 68801; 308/382-1390
 Hansen Cartridge Co., 246 Old Post Rd., Southport, CT 06490; 203/259-5454
 ICI-America, Wilmington, DE 19897; 302/575-3000 (Eley-Kynoch)
 Midway Arms, Inc., 7450 Old Hwy. 40 West, Columbia, MO 65201; 314/445-9521
 Omark Industries, Box 856, Lewiston, ID 83501; 208/746-2351
 Precision Prods. of Wash., Inc., N. 311 Walnut Rd., Spokane, WA 99206; 509/928-0604 (Exammo)
 RWS, (See Dynamit Nobel of America)
 Remington Arms Co., 939 Barnum Ave., P.O. Box 1939, Bridgeport, CT 06601; 203/333-1112
 Service Armament, 689 Bergen Blvd., Ridgefield, NJ 07857; 201/945-2500
 Super Vel, FPC, Inc., Hamilton Rd., Rte. 2, P.O. Box 1398, Fond du Lac, WI 54935; 414/921-2652
 Ten-X Mfg., 2410 East Foxfarm Rd., Cheyenne, WY 82001
 United States Ammunition Co. (USAC), 1476A Thorne Rd., Tacoma, WA 98421; 206/627-8700
 Weatherby's, 2781 E. Firestone Blvd., South Gate, CA 90280; 213/589-7186
 Winchester, Shamrock St., East Alton, IL 62024; 618/258-2000

AMMUNITION (Custom)

Beal's Bullets, 170 W. Marshall Rd., Lansdowne, PA 19050; 215/259-1200 (Auto Mag Specialists)
 Bell's Gun & Sport Shop, 3309-19 Mannheim Rd., Franklin Park, IL 60131
 Brass Extrusion Labs. Ltd., 800 W. Maple Lane, Bensenville, IL 60106; 312/595-2192
 C.W. Cartridge Co., 71 Hackensack St., Wood-Ridge, NJ 07075; 201/438-5111
 Russell Campbell Custom Loaded Ammo, 219 Leisure Dr., San Antonio, TX 78201; 512/735-1183
 Colorado Suttler Ammunition, 7538 E. Fremont Dr., Englewood, CO 80112; 303/771-3363
 Crown City Arms, P.O. Box 1126, Cortland, NY 13045; 607/753-8238
 Cumberland Arms, Rte. 1, Shafer Rd., Blantons Chapel, Manchester, TN 37355
 Denali Bullet Co., P.O. Box 82217, Fairbanks, AK 99701; 907/479-8227
 Eagle Cap Custom Bullets, P.O. Box 659, Enterprise, OR 97828; 503/426-4282
 E.W. Ellis Sport Shop, RFD 1, Box 315, Corinth, NY 12822
 Elwood Epps Northern Ltd., 210 Worthington St. W., North Bay, Ont., Canada P1B 3B4
 Estate Cartridge Inc., P.O. Box 3702, Conroe, TX 77305; 409/539-9144 (shotshell)
 Jack First Distributors, Inc., 44633 Sierra Hwy., Lancaster, CA 93534; 805/945-6981
 Ramon B. Gonzalez, P.O. Box 370, Monticello, NY 12701; 914/794-4515
 R.H. Keeler, 817 N. St., Port Angeles, WA 98362; 206/457-4702
 KTW Inc., 710 Foster Park Rd., Lorain, OH 44053; 216/233-6919 (bullets)
 Dean Lincoln, Custom Tackle & Ammo, P.O. Box 1886, Farmington, NM 87401; 505/632-3539
 Lindsey Arms Cartridge Co., Inc., P.O. Box 5738, Lake Worth, FL 33466; 305/968-1678 (inq. S.A.S.E.)
 Lomont Precision Bullets, 4236 West 700 South, Poneto, IN 46781; 219/694-6792 (custom cast bullets only)
 McConnellstown Reloading & Cast Bullets, Inc., R.D. 3, Box 40, Huntingdon, PA 16652; 814/627-5402
 Numrich Arms Corp., 203 Broadway, W. Hurley, NY 12491; 914/679-7225
 Olsen Development Lab., 307 Conestoga Way #37, Edgeville, PA 19403; 215/631-1716 (Invicta)
 Pearl Armory, Revenden Springs, AR 72460
 Peter's Bullets, 130 E. Vista Way, Vista, CA 92083; 619/724-9611
 Robert Pomeroy, Morison Ave., Corinth, ME 04427; 207/285-7721 (custom shells)
 Precision Ammo Co., P.O. Box 63, Garnerville, NY 10923; 914/947-2720
 Precision Prods. of Wash., Inc., N. 311 Walnut Rd., Spokane, WA 99206; 509/928-0604 (Exammo)
 Anthony F. Sailer-Ammunition, 707 W. Third St., P.O. Box L, Owen, WI 54480; 715/229-2516
 Sanders Cust. Gun Serv., 2358 Tyler Lane, Louisville, KY 40205; 502/454-3338
 Seneca Run, Inc., P.O. Box 332, Greeley, CO 80633
 George W. Spence, 115 Locust St., Steele, MO 63877; 314/695-4926 (boxer-primed cartridges)
 The 3-D Company, Box J, Main St., Doniphan, NE 68832; 402/845-2285 (reloaded police ammo)
 Zero Ammunition Co., Inc., P.O. Box 1188, Cullman, AL 35055; 205/739-1606

AMMUNITION (Foreign)

Beeman Inc., 47 Paul Drive, San Rafael, CA 94903; 415/472-7121
 Dynamit Nobel of America, Inc., 105 Stonehurst Court, Northvale, NJ 07647; 201/767-1660 (RWS, Geco, Rottweil)

Fiocchi of America, Inc., 1306 Chase, Springfield, MO 65803; 417/864-8970
 Hansen Cartridge Co., 246 Old Post Rd., Southport, CT 06490; 203/259-5454
 Norma, (See Outdoor Sports Headquarters, Inc.)
 Hirtenberger Patronen-, Zundhuthcon- & Metallwarenfabrik, A.G., Leobenadorfer Str. 33, A2552 Hirtenberg, Austria
 Paul Jaeger, Inc., 211 Leedom St., Jenkintown, PA 19046; 215/884-8920 (RWS centerfire ammo)
 Kendall International Arms, Inc., 501 East North, Carlisle, KY 40311; 606/289-7336 (Lapua)
 Lapua (See Kendall International, Inc.)
 Outdoor Sports HQ, Inc., 987 Watertower Lane, Dayton, OH 45448; 513/865-5855 (Norma)
 PMC (See Patton and Morgan Corp.)
 Patton and Morgan Corp., 5900 Wilshire Blvd., #1400, Los Angeles, CA 90036; 213/938-0143 (PMC ammo)
 RWS (Rheinische-Westfälische Sprengstoff) (See Dynamit Nobel of America; Paul Jaeger, Inc.)

AMMUNITION COMPONENTS — BULLETS, POWDER, PRIMERS

Accurate Arms Co., Inc., (Propellents Div.), Rte. 1, Box 167, McEwen, TN 37101; 615/729-5301 (powders)
 Alberta Corp., 519 E. 19th St., Paterson, NJ 07514; 201/684-7583 (swaged bullets)
 Ammo-O-Mart Ltd., P.O. Box 125, Hawkesbury, Ont., Canada K6A 2R8; 613/632-9300 (Nobel powder)
 Austin Powder Co. (See Red Diamond Dist. Co.)
 Ballistic Prods., Inc., Box 488, 2105 Shaughnessy Circle, Long Lake, MN 55356; 612/473-1550
 Ballistic Research Industries (BRI), 6000 B Soquel Ave., Santa Cruz, CA 95062; 408/476-7981 (12-ga. Sabot shotgun slug)
 Barnes Bullets, P.O. Box 215, American Fork, UT 84003; 801/756-4222
 Bell's Gun & Sport Shop, 3309-19 Mannheim Rd., Franklin Park, IL 60131; 312/678-1900
 Bitterroot Bullet Co., Box 412, Lewiston, ID 83501; 208/743-5635 (Coin or stamp)
 1506 U.S.; 754 Can. & Mex.; Intl. \$3.00 and #10 SASE for lit.
 B.E.L.L., Brass Extrusion Laboratories, Ltd., 800 W. Maple Lane, Bensenville, IL 60106; 312/595-2792
 Milton Brynir, 214 E Third St., Mount Vernon, NY 10550; 914/664-1311 (cast bullets)
 CCI, (See: Omark Industries)
 CheVron Bullets, R.R. 1, Ottawa, IL 61350; 815/433-2471
 Kenneth E. Clark, 18738 Highway 99, Madera, CA 93637; 209/674-6016 (bullets)
 Denali Bullet Co., P.O. Box 82217, Fairbanks, AK 99701; 907/479-8227 (bullets)
 Division Lead, 7742 W. 61 Pl., Summit, IL 60502; 312/458-4528
 DuPont, Explosives Dept., Wilmington, DE 19898
 Dynamit Nobel of America, Inc., 105 Stonehurst Court, Northvale, NJ 07647; 201/767-1660 (RWS percussion caps)
 Eagle Cap Custom Bullets, P.O. Box 659, Enterprise, OR 97828; 503/426-4282
 Elk Mountain Shooters Supply Inc., 1719 Marie, Pasco, WA 99301 (Alaskan bullets)
 Farmer Bros., 1102 N. Washington, Eldora, IA 50827; 515/858-3651 (Lage wad)
 Federal Cartridge Co., 2700 Foshay Tower, Minneapolis, MN 55402; 612/333-8255 (nickel cases)
 Forty Five Ranch Enterprises, 119 S. Main, Miami, OK 74354; 918/542-9307
 Glaser Safety Slug, 711 Somerset Lane, P.O. Box 8223, Forest City, CA 94404; 415/345-7877
 Godfrey Reloading Supply, Highway 67-111, Brighton, IL 62012 (cast bullets)
 Lynn Godfrey, (See: Elk Mtn. Shooters Supply)
 GOEX, Inc., Belin Plant, Moosic, PA 18507; 717/457-6724 (black powder)
 Green Bay Bullets, P.O. Box 10448, 1486 Servalis St., Green Bay, WI 54307-54304; 414/469-2992 (cast lead bullets)
 GTM Co., George T. Mahaney, 15915B E. Main St., La Puente, CA 91744 (all brass shotshells)
 Hardin Specialty Distr., P.O. Box 338, Radcliff, KY 40160; 502/351-6649 (empty, primed cases)
 Hepplers Gun Shop, 6000-B Soquel Ave., Santa Cruz, CA 95062; 408/475-1235 (BRI 12-ga. slug)
 Hercules Inc., Hercules Plaza, Wilmington, DE 19894; 302/594-8848 (smokeless powder)
 Hodgdon Powder Co., Inc., P.O. Box 2905, Shawnee Mission, KS 66201; 913/382-5410
 Hornady Mfg. Co., Box 1848, Grand Island, NE 68802; 308/382-1390
 Kendall International Arms, Inc., 501 East North, Carlisle, KY 40311; 606/289-7336 (Lapua bull)
 Norma (See Outdoor Sports Headquarters, Inc.)
 N.E. House Co., 195 West High St., E. Hampton, CT 06424; 203/267-2133 (zinc bases in .30, .38, .44 and .45-cal. only)
 Jaro Manuf., P.O. Box 8125, 206 E. Shaw, Pasadena, TX 77506; 713/472-0471 (bullets)
 L.L.F. Die Shop, 1281 Highway 99 North, Eugene, OR 97402; 503/688-5753
 Lage Uniwad Co., 1102 Washington St., Eldora, IA 50827; 515/858-3651
 Ljutic Ind., Inc., Box 2117, Yakima, WA 98902; 509/248-0476 (Mone-wads)
 Lomont Precision Bullets, 4236 West 700 South, Poneto, IN 46781; 219/694-6792 (custom cast bullets)
 Lyman Products Corp., Rte. 147, Middlefield, CT 06455; 203/349-3421
 Michael's Antiques, Box 233, Copleague, L.I., NY 11726 (Balls Blondes)
 Miller Trading Co., 20 S. Front St., Wilmington, NC 28401; 818/782-7107 (bullets)
 Noeler Bullets, P.O. Box 688, Beaverton, OR 97006; 503/646-9171
 Ohio Shooters Supply, 7532 Tyler Blvd., Mentor, OH 44060 (cast bullets)
 Omark Industries, Box 856, Lewiston, ID 83501; 208/746-2351

The Oyster Group, 50 Sims Ave., Providence, RI 02909 (alloys f. casting built)
 Outdoor Sports Headquarters, Inc., 987 Watertown Lane, Dayton, OH 45449; 513/865-5855 (Norma Powder)
 Pyrodes, See: Hodgdon Powder Co., Inc. (black powder substitutes)
 Robert Pomeroy, Morison Ave., East Corinth, ME 04427; 207/285-7721 (empty cases)
 Red Diamond Distributing Co., 1304 Snowden Dr., Knoxville, TN 37912 (black powder)
 Remington-Peters, 939 Barnum Ave., P.O. Box #1939, Bridgeport, CT 06601; 203/333-1112
 S&S Precision Bullets, 22965 La Cadena, Laguna Hills, CA 92653; 714/768-6836 (Linotype cast built)
 Sierra Bullets Inc., 10532 So. Painter Ave., Santa Fe Springs, CA 90670; 213/941-0251
 Speer Products, Box 856, Lewiston, ID 83501; 208/746-2351
 C.H. Stocking, Rte. 3, Box 195, Hutchinson, MN 55350 (17 cal. bullet jackets)
 Supreme Products Co., 1830 S. California Ave., Monrovia, CA 91016; 800/423-7159 or 818/357-5395 (rubber bullets)
 Taylor Bullets, P.O. Box 21254, San Antonio, TX 78221 (cast)
 Taracorp Industries 6th & Cleveland Blvd. Granite City, IL 62040/618-451-4524 (Lawrence Brand Lead shot)
 Vitt & Boos, 2178 Nichols Ave., Stratford, CT 06497; 203/375-6859 (Aerodynamic shotgun slug, 12-ga. only)
 Winchester, Shamrock St., East Alton, IL 62024; 618/258-2000
 Worthy Products, Inc., Box 88 Main St., Chippewa Bay, NY 13623; 315/324-5450 (slug loads)
 Zero Bullet Co. Inc., P.O. Box 1188, Cullman, AL 35055; 205/739-1806

BULLET & CASE LUBRICANTS

Chopie Mfg. Inc., 700 Copeland Ave., La Crosse, WI 54601; 608/784-0926 (Black-Salve)
 Clenzoil Corp., P.O. Box 1226, Sta. C, Canton, OH 44708; 216/833-9758
 Cooper-Woodward, Box 972, Riverside, CA 92502; 714/688-2127 (Perfect Lube)
 Corbin Mfg. & Supply Inc., P.O. Box 2659, White City, OR 97503; 503/826-5211
 Green Bay Bullets, 1486 Servais St., Green Bay, WI 54304; 414/469-2992 (EZE-Size case lube)
 Gussert Bullet & Cartridge Co., Inc., P.O. Box 3945, Green Bay, WI 54303 (Super Lube)
 Hodgdon Powder Co. Inc., P.O. Box 2905, Shawnee Mission, KS 66201; 913/362-5410
 Javelina Products, Box 337, San Bernardino, CA 92402; 714/882-5847 (Alox beeswax)
 Jet-Aer Corp., 100 Sixth Ave., Paterson, NJ 07524; 201/278-8300
 LeClear Industries, 1126 Donald Ave., Royal Oak, MI 48073; 313/588-1025
 Lyman Products Corp., Rte. 147, Middlefield, CT. 06455 (Size-Ezy)
 Marmel Prods., P.O. Box 97, Utica, MI 48087; 313/731-8029 (Marvellube, Marvellux)
 Micro Ammunition Co., P.O. Box 117, Mesilla Park, NM 88047; 505/522-2674 (Micro-Lube)
 Mirror Lube, American Specialty Lubricants, P.O. Box 693, San Juan Capistrano, CA 92693; 714/496-1098
 M&N Bullet Lube, P.O. Box 495, 151 N.E. Jefferson St., Madras, OR 97741; 503/475-2992
 Northeast Industrial, Inc., P.O. Box 249, 405 N. Canyon Blvd., Canyon City, OR 97820; 503/575-2513 (Ten X-Lube; NEI mould prep)
 Pacific Tool Co., P.O. Box 2048, Ordnance Plant Rd., Grand Island, NE 68801; 308/384-2308
 RCBS, Inc., Box 1919, Oroville, CA 95965; 916/533-5191
 SAECO Ref. 2207 Border Ave., Torrance, CA 90501; 213/320-6973
 S&S Precision Bullets, 22965 La Cadena, Laguna Hills, CA 92653; 714/768-6836 (lithium lube)
 Shooters Accessory Supply (SAS) (See Corbin Mfg. & Supply)
 Tarmarack Prods., Inc., P.O. Box 224, Barrington, IL 60010; 312/526-9333 (bullet lube)
 Testing Systems, American Gas & Chemical Co., Ltd., 220 Pagasus Ave., Northvale, NJ 07647; 201/767-7300

BULLET SWAGE DIES AND TOOLS

C-H Tool & Die Corp., 106 N. Harding St., Owen, WI 54460; 715/229-2146
 Lester Coats, 416 Simpson St., North Bend, OR 97459; 503/756-6995 (lead wire core cutter)
 Corbin Mfg. & Supply Inc., P.O. Box 2659, White City, OR 97503; 503/826-5211
 Huntington Die Specialties, P.O. Box 991, Oroville, CA 95965; 916/534-1210
 Independent Machine & Gun Shop, 1416 N. Hayes, Pocatello, ID 83201; 208/232-1264 (TNT bullet dies)
 L.L.F. Die Shop, 1281 Highway 99 North, Eugene, OR 97402; 503/688-5753
 Rorschach Precision Products, P.O. Box 1613, Irving, TX 75060; 214/254-2762
 SAS Dies, (See Corbin Mfg. & Supply)
 Sport Flite Mfg., Inc., 2520 Industrial Row, Troy, MI 48064; 313/280-0648
 TNT (See Ind. Mach. & Gun Shop)

CHRONOGRAPHS AND PRESSURE TOOLS

B-Square Co., Box 11281 Ft. Worth, TX 76110; 800/433-2909
 Custom Chronograph Co., Box 1061, Brewster, WA 98812; 509/689-2004
 Diverter Arms, Inc., P.O. Box 22084, Houston, TX 77027 (press, tool)
 Oehler Research, P.O. Box 9135, Austin, TX 78758; 512/327-6900
 Telepacific Electronics Co., Inc., P.O. Box 1329, San Marcos, CA 92069; 714/744-4415
 Tepeco, P.O. Box 342, Friendswood, TX 77546; 713/482-2702 (Tepeco Speed-Meter)
 M. York, 5508 Griffith Rd., Gaithersburg, MD 20706; 301/253-4217 (press tool)

LABELS, BOXES, CARTRIDGE HOLDERS

Ace Precision Products, Box 2070, Kerrville, TX 78028; 512/257-4290 (targets, Handloader's Almanac)
 Milton Brynin, 214 E. Third St. Mount Vernon, NY 10710; 914/667-6549 (cartridge box labels)
 E-Z Loader, Del Rey Products, P.O. Box 91561, Los Angeles, CA 90009

Peterson Label Co., P.O. Box 186, 23 Sullivan Dr., Redding Ridge, CT 06876; 203/938-2349 (cartridge box labels; Targ-Dots)

LOAD TESTING AND PRODUCT TESTING, (CHRONOGRAPHING, BALLISTIC STUDIES)

Hutton Rifle Ranch, P.O. Box 31868, Tucson, AZ 85751; 602/748-2788
 Kent Lomont, 4236 West 700 South, Poneto, IN 45781; 219/694-6792 (handguns, handgun ammunition)
 Plum City Ballistics Range, Norman E. Johnson, Rte. 1, Box 29A, Plum City, WI 54781; 715/647-2539
 Russell's Rifle Shop, Rte. 5, Box 92, Georgetown, TX 78628; 512/778-5338 (load testing and chronographing to 300 yds)
 John M. Tovey, 4710 104th Lane NE, Circle Pines, MN 55014; 612/786-7268
 H.P. White Laboratory, Inc., 3114 Scarboro Rd., Street, MD 21154; 301/838-6550

RELOADING TOOLS AND ACCESSORIES

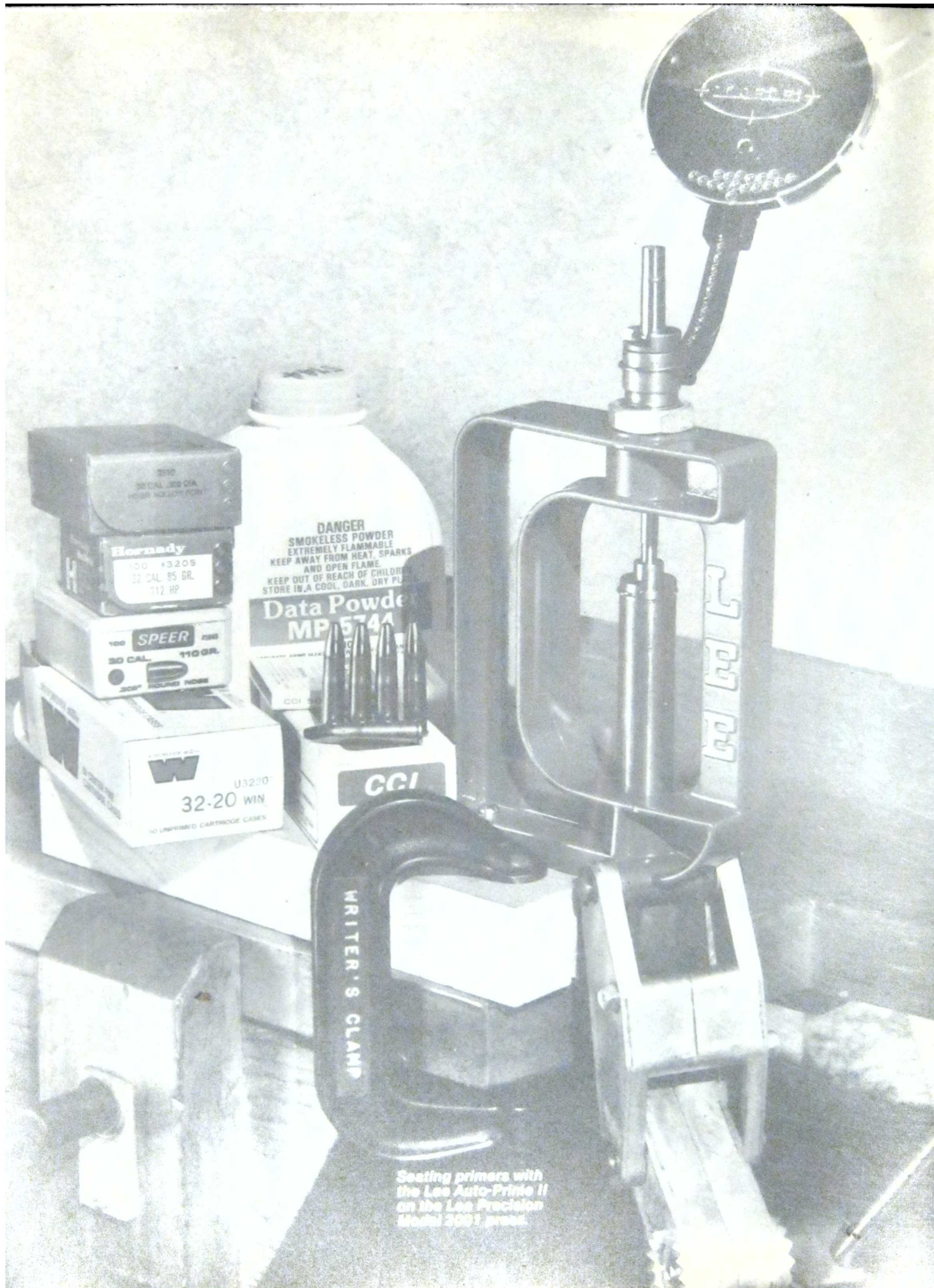
Ace Precision Products, Box 2070, Kerrville, TX 78028; 512/257-4290 (targets, Handloader's Almanac)
 Accessory Specialty Co., 2711 So. 84th St., West Allis, WI 53227; 414/545-0879 (Reload-a-stand)
 Advance Car Mover Co., Inc., P.O. Box 1181, 112 N. Outagamie St., Appleton, WI 54911; 414/734-1878 (bottom pour lead casting ladles)
 Advanced Precision Prods. Co., 5183 Flintrock Dr., Westerville, OH 43081; 614/895-0560 (case super luber)
 American Wad Co., P&P Tool, 125 W. Market St., Morrison, IL 61270; 815/772-7618 (12-ga. shot wad)
 Anderson Mfg. Co., R.R. 1, Royal, IA 51357; 712/933-5542 (Shotshell Trimmers)
 Carco, P.O. Box 308, Highland, CA 92348; 714/862-8311 (Ransom "Grand Master" progr. loader)
 Creighton Audette, 19 Highland Circle, Springfield, VT 05156; 802/885-2331 (Universal Case Selection gauge)
 B-Square Eng. Co., Box 11281, Ft. Worth, TX 76110; 800/433-2909
 Ballistic Prods., P.O. Box 488, 2105 Shaughnessy Circle, Long Lake, MN 55356; 612/473-1550
 Ballistic Research Industries (BRI), 6000-B Soquel Ave., Santa Cruz, CA 95062; 408/476-7981 (shotgun slug)
 Bear Machine Co., 2110 1st Natl. Tower, Akron, OH 44308; 216/253-4039
 Belding & Mull, P.O. Box 428, 100 N. 4th St., Phillipsburg, PA 16866; 814/342-0607
 Berdon Machine Co., Box 483, Hobart, WA 98025; 206/392-1866 (metallic press)
 Blackhawk East, Dowman Greene, C2274 POB, Loves Park, IL 61131; 815/633-7784
 Blackhawk Mtn., Richard Miller, 1337 Delmar Parkway, Aurora, CO 80010; 303/366-3659
 Blackhawk West, R.L. Hough, Box 285, Hiawatha, KS 66434; 303/366-3659
 Bonanza Sports, Inc., 412 Western Ave., Faribault, MN 55021; 507/332-7153
 Gene Bowlin, Rte. 1, Box 890, Snyder, TX 79549; 915/573-2323 (arbor press)
 Brown Precision Co., P.O. Box 270W, 7786 Molinos Ave., Los Molinos, CA 96055; 916/384-2506 (Little Wiggler)
 C-H Tool & Die Corp., 106 N. Harding St., Owen, WI 54460; 715/229-2146
 Camdex, Inc., 2228 Fourteen Mile Rd., Warren, MI 48092; 313/977-1620
 Carbide Die & Mfg. Co., Inc., 15615 E. Arrow Hwy., Irwindale, CA 91706; 818/337-2518
 Carter Gun Works, 2211 Jefferson Pk. Ave., Charlottesville, VA 22903
 Cascade Cartridge, Inc., (See: Omark)
 Cascade Shooters, 60916 McMullin Dr., Bend, OR 97702; 503/389-5872 (bullet seating depth gauge)
 Central Products f. Shooters, 435 Route 18, East Brunswick, NJ 08816 (neck turning tool)
 Chevron Case Master, R.R. 1, Ottawa, IL 61350
 Lester Coats, 416 Simpson St., No. Bend, OR 97459; 503/756-6995 (core cutter)
 Container Development Corp., 424 Montgomery St., Watertown, WI 53094
 Continental Kite & Key Co. (CONKKO), P.O. Box 40, Broomall, PA 19008; 215/353-0711 (primer pocket cleaner)
 Cooper-Woodward, Box 972, Riverside, CA 92502; 714/688-2127 (Perfect Lube)
 Corbin Mfg. & Supply Inc., P.O. Box 2659, White City, OR 97503; 503/826-5211
 Custom Products, RD #1, Box 483A, Saegertown, PA 16443; 814/783-2769 (decapping tool, dies, etc.)
 J. Dewey Mfg. Co., 186 Skyview Dr., Southbury, CT 06488; 203/264-3064
 Dillon Precision Inc., 7755 E. Gelding Dr., Suite 106, Scottsdale, AZ 85260; 602/948-8009
 Diverter Arms, Inc., P.O. Box 22084, Houston, TX 77027 (bullet puller)
 Division Lead Co., 7742 W. 61st Pl., Summit, IL 60502
 Edmisten Co., Inc., P.O. Box 1293, Hwy 105, Boone, NC 28607; 704/264-1490 (I-Dent-A Handloader's Log)
 Efemes Enterprises, P.O. Box 122M, Bay Shore, NY 11706 (Berdan decapper)
 W.H. English, 4411 SW 100th, Seattle, WA 98146 (Paktool)
 Farmer Bros., 1102 N. Washington, Eldora, IA 50627; 515/858-3651 (Lage)
 Flitz, Box 171, Douglas City, CA 96024 (Flitz Flipper)
 Flambeau Plastics Corp., P.O. Box 97, Middlefield, OH 44062; 216/632-1631
 Forster Products Inc., 82 E. Lanark Ave., Lanark IL 61046; 815/493-6360
 Francis Tool Co., P.O. Box 7861, Eugene, OR 97401; 503/746-4831 (powder measure)
 Freechec (See Paco)
 Geo. M. Fuller, 2499 Mavis St., Oakland, CA 94601; 415/533-4193 (seating l.e.)
 Gene's Gun Shop, Rte. 1, Box 890, Snyder, TX 79549; 915/573-2323 (arbor press)
 Gopher Shooter's Supply, Box 278, Faribault, MN 55021
 Hart Products, Rob W. Hart & Son Inc., 401 Montgomery St., Neesopeck, PA 18635
 Hensley & Gibbs, P.O. Box 10, Murphy, OR 97533; 503/862-2341 (bullet moulds)
 Richard Hoch, The Gun Shop, 62778 Spring Creek Rde., Montrose, CO 81401; 303/249-3625 (custom Schuetzen bullet moulds)
 Hoffman New Ideas Inc., 821 Northmoor Rd., Lake Forest, IL 60045; 312/234-4075 (spl. gallery load press)

Homady Mfg. Co., P.O. Box 1848, Grand Island, NE 68802; 308/362-1360
 Hulme (see Marshall Enterprises — Star Case feeder)
 Huntington, P.O. Box 991, Oroville, CA 95965; 916/543-1210 (Compact Press)
 Independent Mech. & Gun Shop, 1416 N. Hayes, Pocatello, ID 83201; 208/232-1264
 Javelina Products, Box 337, San Bernardino, CA 92402 (Alox beeswax)
 Neil Jones, RD #1, Box 483A, Saegertown, PA 16433; 814/763-2769 (decapping tool, dies)
 Paul Jones Munitions Systems (See Fitz Co.)
 Kexplora, P.O. Box 22084, Houston, TX 77027; 713/789-6943
 Kuharsky Bros. (See Modern Industries)
 Lage Uniwad Co., 1102 N. Washington St., Eldora, IA 50827 (Universal Shot-shell Wad)
 Lee Precision, Inc., 4275 Hwy. U, Hartford, WI 53027; 414/673-3075
 L.L.F. Die Shop, 1281 Highway 99 N., Eugene, OR 97402; 503/688-5753
 Dean Lincoln, Custom Tackle & Ammo, P.O. Box 1886, Farmington, NM 87401 (mould)
 Ljotic Industries, 918 N. 5th Ave., Yakima, WA 98902; 509/632-3539
 Lock's Phila. Gun Exch., 6700 Rowland, Philadelphia, PA 19149; 215/332-6225
 Lyman Products Corp., Rte. 147, Middlefield, CT 06455; 203/349-3421
 McKillen & Heyer Inc., 37803 Arlington Dr., Box 627, Willoughby, OH 44094; 216/942-2491 (case gauge)
 Paul McLean, 2670 Lakeshore Blvd., W., Toronto, Ont., Canada M8V 1G8; 416/259-3060 (Universal Cartridge Holder)
 'EC, Inc. (See Mayville Eng. Co.)
 MTM Molded Prod., 8000 Obco Ct., P.O. Box 14117, Dayton, OH 45414; 513/890-7461
 Magma Engineering Co., Box 161, Queen City, AZ 85242
 Marmel Prods., P.O. Box 97, Utica, MI 48087; 313/731-8029 (Marvelube, Marvelux)
 Marquant Precision Co., P.O. Box 1740, Prescott, AZ 86302; 602/445-5646 (precision case-neck turning tool)
 Marshall Enterprises, 792 Canyon Rd., Redwood City, CA 94062; 415/365-1230 (Hulme autom. case feeder f. Star rel.)
 Mayville Eng. Co., 715 South St., Mayville, WI 53050; 414/387-4500 (shotshell loader)
 Mequon Reloading Corp., P.O. Box 253, Mequon, WI 53092; 414/673-3060
 Merit Gun Sight Co., P.O. Box 995, Sequim, WA 98382; 206/883-6127
 Multi-Scale Charge Ltd., 55 Maitland St., #310, Toronto, Ont., Canada M4Y 1C9; 416/967-5305
 Normington Co., Box 6, Rathdrum, ID 83858 (Powder baffles)
 NorthEast Industrial Inc., N.E.I., P.O. Box 249, 405 N. Canyon Blvd., Canyon City, OR 97828; 503/575-2513 (bullet mould)
 J. Northcote, Box 5158, Hacienda Heights, CA 91745; 818/968-5806 (hollow pointer)
 Ohaus Scale, (See RCBS)
 Omark Industries, Box 856, Lewiston, ID 83501; 208/746-2351
 P&P Tool Co., 125 W. Market St., Morrison, IL 61270; 815/772-7818 (12-ga. shot wad)
 Pacific Tool Co., P.O. Box 2048, Ordinance Plant Rd., Grand Island, NE 68801; 308/384-2308
 Paco, Box 17211, Tucson, AZ 85731 (Freechec tool for gaschecks)
 Pak-Tool Co., 4411 S.W. 100th, Seattle, WA 98146
 Pam's Manufacturing Co., 5063 Waterloo Rd., Atwater, OH 44201; 216/947-2202 (pedestal cranks, primer pocket cleaner)
 Pitzer Tool Mfg. Co., Rte. 1, Box 50, Winterset, IA 50273; 515/462-4268 (bullet lubricator & sizer)
 Plum City Ballistics Range, Norman E. Johnson, Rte. 1, Box 29A, Plum City, WI 54761; 715/647-2539
 Ponsness-Warren, Inc., P.O. Box 8, Rathdrum, ID 83858; 208/687-1331
 Marian Powley, Petra Lane, R.R.1, Eldridge, IA 52748; 319/285-9214
 Precise Alloys Inc., 406 Hillside Ave., New Hyde Park, NY 11040; 516/354-8860 (chilled lead shot; bullet wire)
 Quinetics Corp., P.O. Box 29007, San Antonio, TX 78229; 516/684-8561 (kinetic bullet puller)
 RCBS, Inc., Box 1919, Oroville, CA 95965; 916/533-5191
 Redding Inc., 114 Starr Rd., Cortland, NY 13045
 Reloading Equipment Co., 4680 High St., Ecorse, MI 48229 (bullet puller)
 Reloading Paper Supply, Don Doerksen, P.O. Box 550, Hines, OR 97738 (reloader's record book)
 Rifle Ranch, Rte. 10, 3301 Willow Creek Rd., Prescott, AZ 86301; 602/778-7501
 Rochester Lead Works, 76 Anderson Ave., Rochester, NY 14607; 716/442-8500 (leadwire)
 Rorschach Precision Prods., P.O. Box 1613, Irving, TX 75060; 214/254-9762 (carboly bul. dies)

Rotax Mfg. Co. (See Tessen)
 SAECO Rel., 2207 Border Ave., Torrance, CA 90501; 213/330-6978
 S&K Industries, Rte. 1, Delta Drive, Bloomington, OH 43810; 614/284-0178 (primer tool)
 Sandia Die & Cartridge Co., Rte. 5, Box 5400, Albuquerque, NM 87125; 505/286-5729
 Shannon Associates, P.O. Box 32787, Oklahoma City, OK 73153
 Shiloh Products, 181 Plauderville Ave., Carlisle, NJ 07026 (4-cavity bullet mould)
 Shooters Accessory Supply, (See Corbin Mfg. & Supply)
 Sil's Gun Prod., 490 Sylvan Dr., Washington, PA 15301 (K-spinner)
 Jerry Simmons, 715 Middlebury St., Goshen, IN 46526; 219/633-8546 (Pope de-capper, recapper)
 J.A. Somers Co., P.O. Box 49751, Los Angeles, CA 90049 (Jasco)
 Sport Flite Mfg., Inc., 2520 Industrial Row, Troy, MI 48064; 313/280-0646 (swag-ing dies)
 Star Machine Works, 418 10th Ave., San Diego, CA 92101; 619/232-3216
 TEK Ind., Inc., 2320 Robinson St., Colorado Springs, CO 80904; 303/630-1296 (Vibra Tek Brass Polisher & Medium, Vibra Brite Rouge)
 T&T Products, Inc., 6330 Hwy. 14 East, Rochester, MN 55901 (Meyer shotgun slugs)
 Texan Reloaders, Inc., 444 So. Cipe St., Watauga, IL 60970; 615/432-5065
 Trico Plastics, 590 S. Vincent Ave., Azusa, CA 91702
 Tru Square Metal Products, P.O. Box 585, Auburn, WA 98002; 206/833-2310 (Thumler's tumbler case polishers; Ultra Vibe 18)
 WAMADET, Silver Springs, Goodleigh, Barnetlepe, Devon, England
 Walker Mfg. Inc., 8296 So. Channel, Harlan's Island, MI 48028 (Borden decapper)
 Wammes Guns Inc., 236 N. Hayes St., Bellefontaine, OH 43311 (Jim's powder baffles)
 Weatherby, Inc., 2781 Firestone Blvd., South Gate, CA 90280; 213/568-7186
 Weaver Arms Corp., 344 No. Vinewood St., Escondido, CA 92025; 619/745-4342 (progr. loader)
 Webster Scale Mfg. Co., P.O. Box 188, Sebring, FL 33870; 813/385-6362
 Whits Shooting Stuff, P.O. Box 1340, Cody, WY 82414
 L.E. Wilson, Inc., P.O. Box 324, 404 Pioneer Ave., Cashmere, WA 98815; 509/782-1328
 Zenith Enterprises, 5781 Flagler Rd., Nordland, WA 98356; 206/385-2142

RESTS — BENCH, PORTABLE, ETC.

A&A Design & Manufacturing, 361 SW "K" St., Grants Pass, OR 97526; 503/474-1026 (Tour de Force bench rest)
 B-Square Co., P.O. Box 11281, Ft. Worth, TX 76109; 800/433-2909 (handgun)
 Jim Brobst, 299 Poplar St., Hamburg, PA 19526; 215/562-2103 (bench rest pedestal)
 Bullseye Shooting Bench, 8100 40th St. Vancouver, WA 98661; 206/694-6141 (portable)
 C'Arco, P.O. Box 308, Highland, CA 92346; 714/862-8311 (Ransom Rest)
 Centrum Products Co., 443 Century S.W., Grand Rapids, MI 49503; 616/454-9424 (Porta Bench)
 Cravener's Gun Shop, 1627 5th Ave., Ford City, PA 16226; 412/763-8312 (portable)
 Decker Shooting Products, 1729 Laguna Ave., Schofield, WI 54476 (rifle rests)
 The Gun Case, 11035 Maplefield, El Monte, CA 91733
 Joe Half's Shooting Products, Inc., 443 Wells Rd., Doylestown, PA 18901; 215/345-6354 (adj. portable)
 Harris Engineering, Inc., Barlow, KY 42024; 502/334-3633 (bipod)
 Rob.W. Hart & Son, 401 Montgomery St., Nescopeck, PA 18835
 Tony Hidalgo, 12701 S.W. 9th Place, Davie, FL 33325 (adj. shooting seat)
 Hoppe's Div., Penguin Industries, Inc., Airport Industrial Mall, Coatesville, PA 19320; 251-384-6000 (bench rests and bags)
 North Star Devices, Inc., P.O. Box 2095, North St. Paul, MN 55109 (Gun Slinger)
 Progressive Prods., Inc., P.O. Box 67, Homen, WI 54636; 608/526-3345 (Sand-bagger rifle rest)
 Rec. Prods. Res., Inc., 158 Franklin Ave., Ridgewood, NJ 07450 (Butts Bipod)
 Suter's Inc., House of Guna, 332 N. Tejon, Colorado Springs, CO 80902; 303/635-1475
 Tuller & Co., Bash Tuller, 29 Germania, Galeton, PA 16922; 814/435-2442 (Protector sandbags)
 Turkey Creek Enterprises, Rte. 1, Box 10, Red Oak, OK 74563; 918/754-2884 (portable shooting rest)
 Wichita Arms, 444 Ellis, Wichita, KS 67211; 316/265-0612



Seating primers with
the Lee Auto-Prime II
on the Lee Precision
Model 2001 press.